VisiCalc®

INSTANTLY CALCULATING 'ELECTRONIC WORKSHEET'

User's Guide for the ATARI 800 32K

Program by
Software Arts, Inc.
Cambridge, Massachusetts

Manual by
Dan Fylstra and Bill Kling

VisiCorp™
PERSONAL SOFTWARE™

Table of Contents

PART I. INTRODUCTION

PART II. VISICALC TUTORIAL

Lesson One

Lesson Two

Lesson Three

Lesson Four

PART III. VISICALC COMMAND REFERENCE

PART IV. INDEX

Table of Contents

PART I. INTRODUCTION

Introduction

How to Use This Manual

This manual has been carefully prepared to help you learn VisiCalc easily and quickly. Its four sections take into account the fact that different people using VisiCalc will have differing levels of computer experience.

Part I contains an overview of VisiCalc, information about your equipment needs, complete instructions for loading VisiCalc, and preparing diskettes for use with VisiCalc.

Part II is a step by step Tutorial in the use of VisiCalc with your ATARI® 800™. Those with little or no experience with personal computers will find that it anticipates many of the questions and problems that may arise. The Tutorial comprises four lessons that guide you from the point at which you finish loading VisiCalc in Part I through several examples.

These examples show you how to use VisiCalc and your computer to solve problems in your professional and personal life. Each lesson will show you exactly what to type, keystroke by keystroke, and should be studied by working at the computer. As you practice, you'll gain familiarity and confidence in using some of the more advanced features of VisiCalc. Before long, you'll need only Part III and the VisiCalc Reference Card.

Part III is the VisiCalc Command Reference. It contains a chart of VisiCalc commands illustrating their relationship, notes on the elements of the VisiCalc screen display, and a detailed discussion of each command with examples of its use. You will probably find yourself referring to this section frequently, especially as you use the advanced features of VisiCalc to speed your work and do complicated applications. The commands presented in this part of the manual are summarized in the VisiCalc Reference Card.

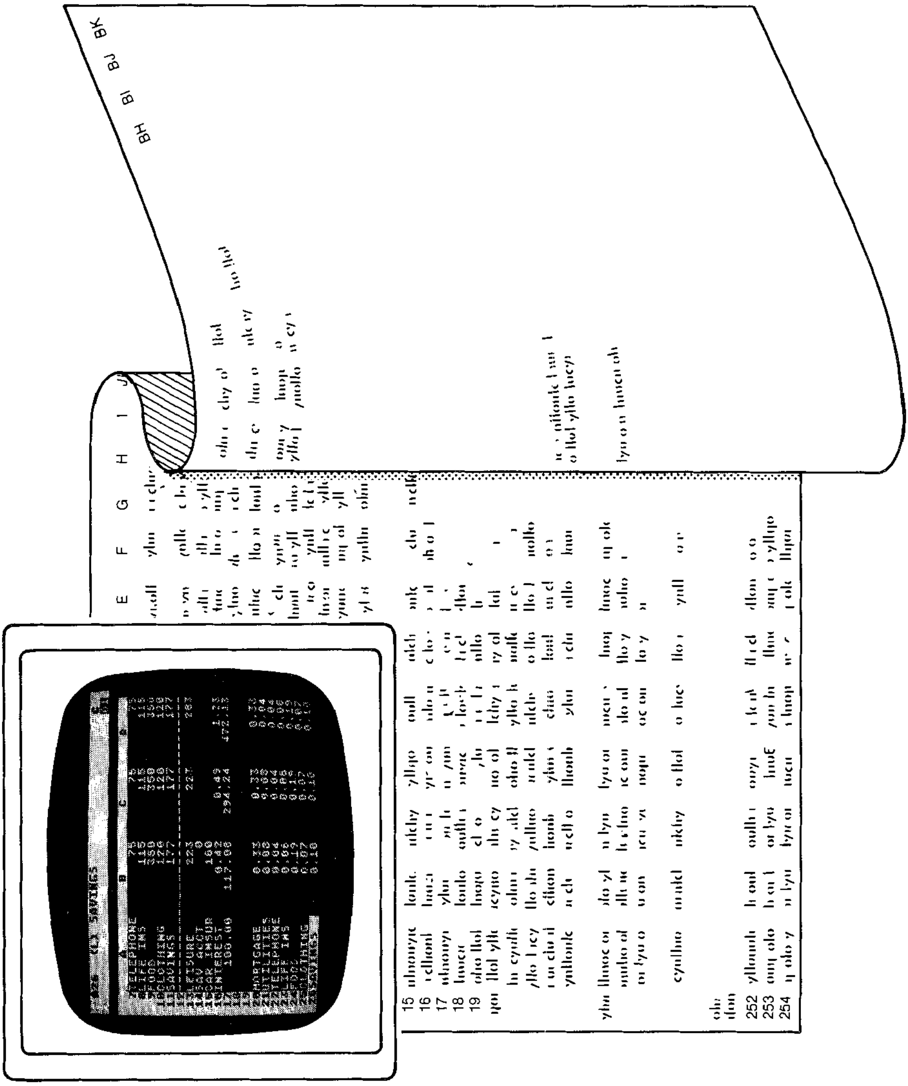
Part IV is the Index for this manual. It alphabetically lists subjects with their page numbers.

The best way to learn to use VisiCalc is to try it. Experiment! Trying out ideas will help you answer a lot of your questions, while enhancing your experience and confidence. Entering "odd" data and patterns will hurt neither the computer nor the VisiCalc program. Physical care, however, must be paid both to the computer and the diskettes. Always handle diskettes gently, keeping them away from magnetism, dirt, and liquids.

Overview Of VisiCalc: The "Electronic Sheet"

VisiCalc was born out of the observation that many problems are commonly solved with a calculator, a pencil, and a sheet of paper—three nearly universal tools. Calculating sales projections, income taxes, financial ratios, your personal budget, engineering changes, cost estimates, and balancing your checkbook are all done with these tools.

VisiCalc combines the convenience and familiarity of a pocket calculator with the powerful memory and electronic screen capabilities of the personal computer. With VisiCalc, the computer's screen becomes a "window" that looks upon a much larger "electronic sheet." You can move or "scroll" this window in four directions to look at any part of the sheet, or you can split the computer screen into two "windows" to see any two parts of the sheet at the same time.



YOUR SCREEN IS A WINDOW INTO THE ELECTRONIC SHEET IN THE COMPUTER'S MEMORY

The sheet is organized as a grid of columns and rows. The intersecting lines of the columns and rows define thousands of entry positions. At each position you can enter an alphabetic title, a number, or a formula to be calculated. Just by "writing" on the sheet, you can set up your own charts, table, and records. The formatting commands let you individualize the appearance of each entry, row, or column. If you wish, for example, you can make your VisiCalc checkbook record look just like your bank statement.

But the power of VisiCalc lies in the fact that the computer **remembers** the formulas and calculations you use as you work through a problem. If you change a number you had previously written on the electronic sheet, all other related numbers on the sheet change before your eyes as VisiCalc automatically recalculates all of the relevant formulas.

Recalculation makes VisiCalc a powerful planning and forecasting tool. Not only can you effortlessly correct mistakes and omissions, you can also examine various alternatives.

For example, imagine that you are doing sales projections using VisiCalc. You may want to know what the impact on your company will be if a specific project doesn't sell as well as you had anticipated. What if you sell only 200 "widgets" a month instead of 250? What if you sell 300? What if one of your salesmen quits, and it takes six weeks to bring a new person up to speed? Playing "what if" with VisiCalc is usually a matter of changing a single number. Doing the same thing with a calculator, pencil, and paper might takes hours of erasing and recalculating.

VisiCalc's editing features let you change, insert, or delete titles, numbers, or formulas. The existing VisiCalc chart or table is instantly restructured with all of the columns, rows, and other formulas edited to reflect your changes.

If you've entered a formula at one position, VisiCalc lets you replicate it at any number of other positions. VisiCalc will also sum, average, or otherwise manipulate rows, columns, or other ranges of numbers.

While you can shorten the length of titles and numbers that are displayed on your computer screen, the internal length of titles and formulas remains constant. Decreasing the length of each position on the screen lets you increase the number of positions displayed without affecting their content. To see the title or formula that produced a number, you simply move the screen highlight or "cursor" to rest on that number or title.

Once you've established the format for a particular application, you just enter or change numbers. You can save the electronic sheet on a diskette, and you can print all or part of the sheet on a printer.

You can learn the elementary features of VisiCalc in an hour or two, and you'll immediately be able to solve simple problems. As you use VisiCalc for more complicated applications, you'll discover that it has a broad range of features and commands. You can learn these features and commands as the need arises.

Important Follow-Up Program

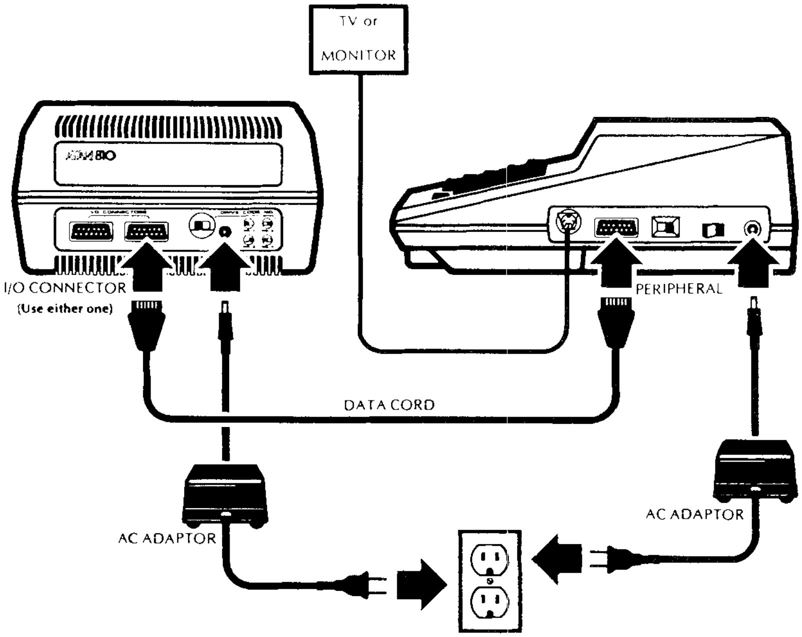
Please read the User's Support Plan that comes with this product. Returning the warranty registration card will enable us to keep you informed of new versions of the VisiCalc program.

After you've used VisiCalc, we'd like to hear your comments and suggestions for improvement. We have provided the Reader Critique at the back of this manual for this purpose.

What You Need

To use VisiCalc, you will need the following components:

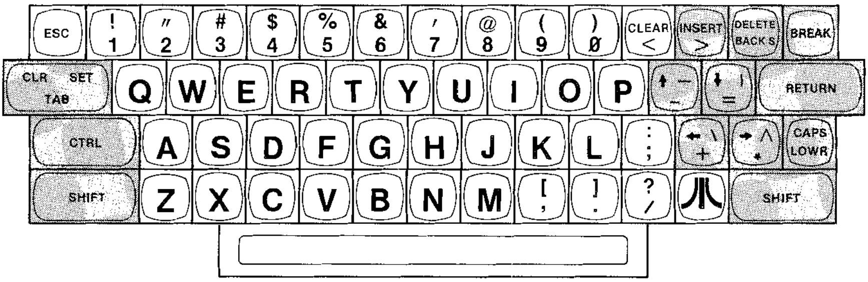
1. Your ATARI 800(TM).
2. The ATARI 810(TM) Disk Drive for 5″ floppy diskettes.
3. A set of blank diskettes.
4. The VisiCalc program diskette, enclosed in the inside front cover pocket of your manual.
5. ATARI RAM Memory Modules totaling at least 32K. A total of 48K of RAM is highly recommended.
6. A TV set or other video monitor. A black and white set is fine.
7. Optionally, you may choose either the ATARI 820(TM) or ATARI 825(TM) printers for making hard copy reports of your sheets. Another option is the ATARI 850(TM) Interface Module.



EQUIPMENT HOOK-UP

Some Notes On Your Keyboard

This manual describes the use of VisiCalc on the Atari 800 computer. We tell you keystroke by keystroke how to enter each command. Everything will be illustrated with numerous examples. We do assume, however, that you will press the **SHIFT** key if necessary. Use the **SHIFT** just like you would on a typewriter, i.e., holding it down while you type the key with the character you want.



THE ATARI 800 KEYBOARD

With the ATARI keyboard illustrated above, you do not use the **SHIFT** to type special characters such as the asterisk (*) and the greater than sign (>). However, you will need to press the **SHIFT** to generate some of the non-alphabetic characters you'll be using, such as quotation marks ("), exclamation point (!), and the at sign (@).

Also note the positions of the keys that are shaded in the keyboard drawing. You will use them a great deal. Throughout this manual, we will substitute the symbol, ® for the key labeled **RETURN**.

The four keys with the little arrows on them are used in conjunction with the Control key (marked **CTRL**) to move the cursor on your VisiCalc screen. In this manual, the following symbols represent the use of these keys, and also our notation for the exponentiation character ^.

Symbol	**Keystrokes**
↓	*Hold down* **CTRL** and *press* [↓ | =]
↑	*Hold down* **CTRL** and *press* [↑ _ -]
→	*Hold down* **CTRL** and *press* [→ ^ *]
←	*Hold down* **CTRL** and *press* [← \ +]
^	*Hold down* **SHIFT** and *press* [→ ^ *]

Since the ATARI 800 computer uses both upper and lower case, you can use the **SHIFT** to make individual capital letters, as you would on a typewriter, when you are creating titles for your VisiCalc sheet. You may also use **SHIFT** and the **CAPS LOWR** key to "lock" in the all-capitals mode. Be sure to "unlock" **CAPS LOWR** by pressing it once as soon as you've finished capitalizing. While the **CAPS LOWR** is on, some of the keys you need may not work as described here.

Whether you type a letter in upper or lower case does not matter to VisiCalc—it will automatically capitalize letters where it is necessary for a command, such as >A1, or a formula such as 8+A1. Note that in the text of this manual, we use only upper case to explain what to type and what you see on the screen.

A Word on Diskettes

A word of caution about the handling of diskettes is in order here—you can't be too careful with diskettes. Each diskette is a small, magnetically coated plastic disk, sealed in a protective square plastic cover. Through the oval cut-out in the square cover, you can see the magnetic surface of the actual diskette.

Never touch the exposed magnetic surface with your fingers or any implement. Protect the diskette from dust by storing it in the paper sleeve it comes in. Keep it at least six inches from magnetic fields such as those generated by a TV. Extremes of temperature (such as in a car trunk on a warm day) could destroy a diskette, and you would lose your data, or your VisiCalc program. Don't bend, staple, or write on the square plastic cover with a hard pen or pencil (use only the soft felt tip pens).

Loading VisiCalc

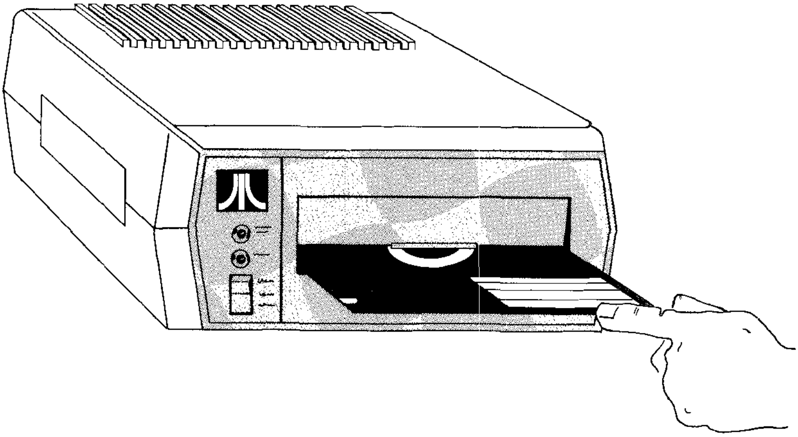
Whether your computer is on or off, begin by removing any ATARI ROM cartridges from the left and right slots of the forward cartridge bay. VisiCalc will not run if any such cartridges are present. Note, however, that the *Memory Bank* toward the back of the console must contain the 10K ROM Operating System Module and a *total* of at least 32K RAM of Memory Modules.

Check your disk drive(s) next. Make sure that the BUSY light is not on, then open the door (by pressing on the button beneath the door) of each disk drive and remove any diskette that might be present. Leave the drive door(s) open. Do not insert the VisiCalc diskette yet.

If your equipment is turned off, begin by turning on your TV set. Press the power switch (located on the front of the drive) to the "ON" position. The drive motor will start up and run for about 6 seconds. When it stops, the BUSY light will go out, but the PWR. ON light will remain lit.

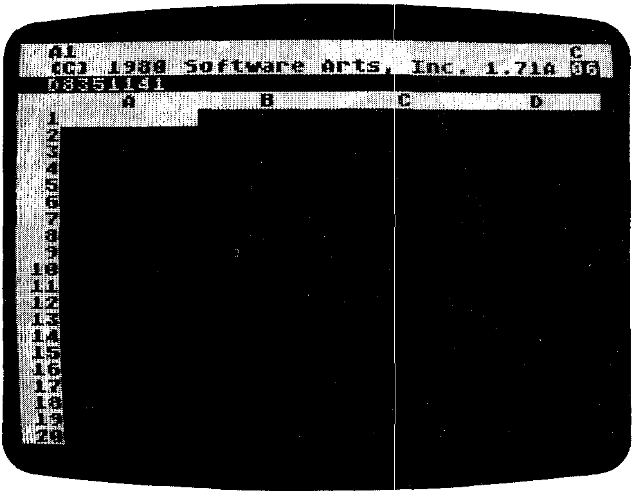
Take the VisiCalc program diskette from the pocket on the inside front cover of your manual. Remove the VisiCalc program diskette from its paper sleeve and grasp the diskette by the label edge with the label side up. Carefully insert it into drive 1, with the label edge entering last (see illustration below). Gently push the diskette all the way in. Close the drive door by pushing its handle down, until you hear the door click shut.

Note: VisiCalc will load only from a disk drive with a DRIVE CODE number of 1. This number is set by the recessed switches at the rear of the drive. See page 3 of your disk manual for details.



Now turn the computer on by pushing the power switch to the ON position. If your computer was already on, turn it off, pause a moment, then turn it back on. The switch is located on the right side of the computer, just past the 2-CHAN-3 switch. On the console, the red light just below the START button will also light. The drive takes about half a minute to load VisiCalc into RAM memory.

As the program loads, the VisiCalc screen will appear and should resemble the photo below. The second line contains the copyrght notice and the version number. The third line contains a serial number unique to your particular diskette. As with any valuable item, write this number down and store it in a safe place.



If you screen doesn't look like the one above, **remove your VisiCalc diskette from the drive**. Then turn off the disk drive and the computer and try again, using the "Loading VisiCalc" instructions. If after several tries you are not successful at loading VisiCalc, see your dealer for help.

When VisiCalc has loaded correctly, the disk drive has stopped whirring, and the BUSY light is off, open the drive door and gently remove your VisiCalc program diskette. Put it back in its sleeve (label showing) before returning it to the inside front cover pocket of your VisiCalc binder; you won't need it again until the next time you turn on your computer.

Never leave your VisiCalc program diskette in the drive. It could be harmed by power failures or mechanical failures in the drive. Be careful too with your data storage diskettes. Although they are replaceable, misuse can lose hours of work. Always remove a diskette before turning off the drive. And **NEVER** open the drive door, try to remove a diskette, or turn the power off when the BUSY light is on.

Initializing VisiCalc Storage Diskettes

You must make a working diskette for storing the information you will be creating with VisiCalc. Take out a blank diskette. Notice that a blank diskette has a small notch cut out on its left side. This cutout is sensed by your disk drive, and it tells the computer that it is okay to write information on the diskette surface. For its protection, the VisiCalc program diskette does not have this notch; hence it is said to be "write-protected."

Look for the adhesive labels that normally come with a box of blank diskettes. Write some identifier on the label like, "VisiCalc Storage Disektte #1." Add the date and apply this label to the diskette jacket near the manufacturer's label. If the title label is already on the diskette, be sure to use a felt tip pen, not a ballpoint. If you intend to initialize more than one diskette, make up additional labels and apply them as well.

Carefully insert the blank diskette into drive 1 just as you did with the VisiCalc program diskette. The label must be up and the oval cutout must go in first. Close the disk drive door.

A brief note before continuing. The ATARI 800 automatically changes screen colors when you don't use it for a period of time. The purpose of this is to protect the screen from having patterns literally burned on to it. To return to the normal light blue (or grey) screen, simply hit any key.

Follow the instructions below, and watch the second line from the top of the screen. This line is called the VisiCalc **prompt line**, and is described more fully in Lesson One of Part II and in Part III.

1. Press the **/** key. Your serial number and the title will disappear from the screen. The prompt line will read

   `COMMAND: BCDFGIMPRSTVW-`

2. Press the letter **S** key. The prompt line should read

   `STORAGE: L S D I Q #`

3. Press the letter **I** key. The prompt line should read

   `INIT DISK:HIT RETURN (ERASES DISK)`

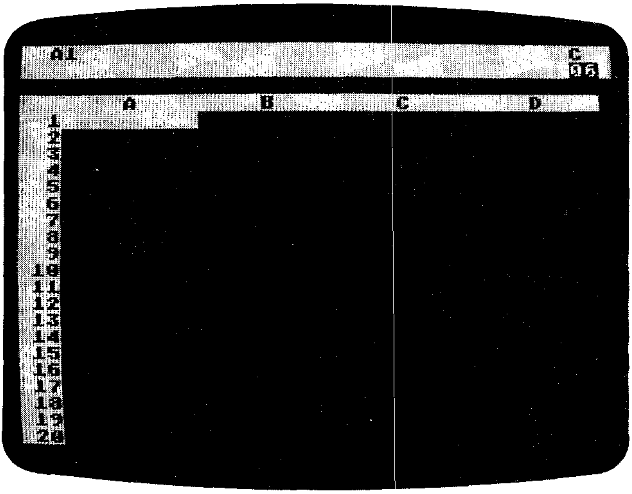
   The characters `D1:` are under it. For information on the meaning and use of these characters, see the discussion of The STORAGE Command in Part III.

4. Just press ® (the RETURN key). The red BUSY light on the drive should come on, accompanied by whirring and scraping noises. It should take about less than a minute to complete the initialization process. Toward the end of that time, the characters D1: and the INIT message will disappear from the screen.

In the initialization process, the computer is recording a pattern on the surface of the diskette, so that VisiCalc can find a given spot on the diskette surface and "write" information there or "read" it back later. What's more, information "written" by one program (such as VisiCalc) can be located later and "read" by a different program (which could be written in BASIC). If you initialize a diskette that has had data stored on it from some previous use, either by VisiCalc or some other program, that data will be erased by this process.

After the disk drive quiets down and the red BUSY light goes off, open the drive door and carefully remove the newly initialized diskette. Never open the door or insert or remove a diskette while the drive is whirring or the BUSY light is on; this will probably damage the diskette. Immediately place the new diskette back in its paper sleeve.

At this point, you may wish to initialize some additional diskettes for use with VisiCalc. Simply insert a new blank diskette, close the drive door, and follow the four- step initialization procedure above. When you've finished, you'll be ready to go on to Lesson One of the Tutorial and begin learning to use VisiCalc. Your screen should look like the photo below.

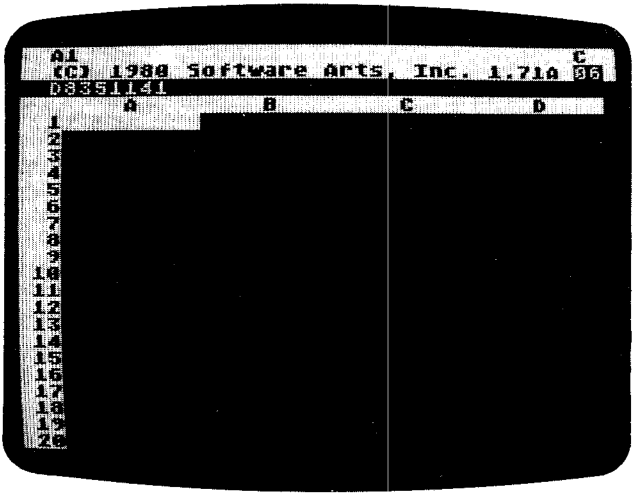


PART II. VISICALC TUTORIAL

Lesson One

Lesson One

When you have loaded VisiCalc into your computer, as described in the section entitled "Loading VisiCalc," the image on your screen should resemble the photo shown in that section. The same photo is reproduced below. Type the following keys: **/CY** to clear the sheet and make it look like the photograph. Now we'll exmaine the components of this screen image more closely.



Your screen has become a **window** into the computer's memory, which VisiCalc has organized like an **electronic sheet**. As you can see, the sheet is divided into rows which are numbered 1, 2, 3, and so on, and columns which are lettered A, B, C, and so on. At each intersection of a row and column there is an **entry position**, with a **coordinate** such as A1, B3, C17, and so forth. At each entry position you can "write" a message or title, a number, or a formula of the kind you might enter, keystroke by keystroke, on a calculator. In a moment we'll demonstrate how you move around and write on this electronic sheet.

Above the white border with the column letters, there are three additional lines which make up VisiCalc's **control panel**. The middle line of this control panel displays the VisiCalc copyright notice and **version number**, for example:

```
(C) 1980 SOFTWARE ARTS, INC. 1.71A
```

Should you ever need to call or write VisiCorp to ask questions or to report problems with VisiCalc, please tell us your version number and the model of your computer. The third line contains another important number: the serial number unique to your particular VisiCalc diskette.

Press the key marked **RETURN**. As we mentioned in the section "Notes on Your Keyboard" in Part I, we'll indicate the **RETURN** key with the symbol ®. The copyright notice, version number, and serial number will disappear. Now press the **/** key followed by the **V** key and all three will reappear. Just type **/V** anytime

you want to see your version number and most any key to make this version information disappear. See the VERSION command in the reference section for more information.

Moving the Cursor

Look at the point where column A and row 1 intersect. This is coordinate A1. To keep you from getting lost on the electronic sheet, VisiCalc prints the coordinate for you on the upper line of the control panel. See it? Notice that a white bar covers entry position A1, blending into the top and left frames of the screen. This bar is called the **cursor**. You always write on the electronic sheet at the position marked by this cursor; you can think of it as the point at which your pencil or pen meets the paper. To move the cursor around, you must always hold down the Control key (marked **CTRL**), while pressing one of the four arrow keys ↓ ↑ → ←. The manual will remind you to use **CTRL** for the first few examples, to help you get used to it.

Hold down the **CTRL** key and simultaneously press the right arrow key → once. Notice that the cursor moves to the position at column B, row 1 and makes a soft click. VisiCalc sounds this noise each time you type a character. Look at the cursor coordinate in the upper left corner of the control panel. It has changed to B1. Your first key stroke also caused the copyright notice and version number to disappear.

Now press the left arrow key ← (remember to press the **CTRL** key) and watch the cursor move back to its original position at A1. Try moving the cursor down to row 2 of column A with ↓ and then back to position A1 with ↑ And don't forget the **CTRL** key.

If, while you are practicing, you make a typing error and see either the word VALUE or LABEL appear on the second line of the control panel, don't worry. Just press the key marked **BREAK**, and the word will disappear along with the number or letter beneath it. The noise made by the **BREAK** key is called a beep. We'll go into more detail on the words Value and Label and correction methods a little later in the manual.

Scrolling the Window

When you first load VisiCalc, your screen window is positioned to let you look at the upper left corner of VisiCalc's electronic sheet. On the ATARI 800, the window allows you to see the first four columns (A through D) and the first twenty rows (1 through 20) of the sheet.

Now with the cursor at A1, press the right arrow key → three times, until the cursor rests at the right edge of the window at D1. Press the right arrow key → again. Notice that the next column to the right, the E column, comes into view while column A disappears off the left edge of the window.

When this happens, we say that the window has **scrolled** to the right. Try pressing → a few more times, watching more columns appear at the right edge of the window while others disappear at the left.

The screen window will also scroll to the left. (In fact, it will scroll in all four directions.) Press the left arrow key ← (don't forget **CTRL**) until the cursor is at

the left edge of the window. Then press ← several more times and notice that the columns that had disappeared as you scrolled the window to the right come back into view. Press ← until the cursor is back at position A1.

Now try pressing ← one more time. You should hear a soft buzzing noise called a thud. This is VisiCalc's way of telling you that you are bumping into an edge of the sheet.

Press **CTRL** and the up-pointing arrow key ↑ that would normally move the cursor up. This time you hear the thud because you are bumping the cursor into the top edge of the sheet. So far we have encountered the left edge and the top edge of the sheet. Now we will show you the other two edges.

Press the down arrow key ↓ until the cursor has moved down to position A20. Then press ↓ again and notice that row 21 comes into view while row 1 disappears off the top of the screen window. Press the ↓ key a few more times. As you can see, the electronic sheet is quite a bit larger than an ordinary sheet of paper.

Automatic Repeat

We can reach the bottom edge of the sheet more quickly by using the ATARI's automatic repeat feature. To see this in action, press the ↓ key again, and this time *hold it down*. The cursor and the window should scroll downwards automatically. Continue to hold down the ↓ key until you bump into the bottom edge of the electronic sheet. The cursor will be at position A254.

Now let's move the cursor to the right hand edge of the sheet. Press → and hold it down. The cursor and window will go scrolling off to the right. As the cursor and window scroll to the right, notice how succeeding columns are lettered. All these coordinates can still be read at the upper left corner of the screen too. After A, B, C, . . . , X, Y, Z comes AA, AB, AC, . . . , AX, AY, AZ, and then BA, BB, BC, . . . The cursor finally stops at position BK254 as it bumps into the right hand edge of the sheet. You are now at the lower right hand corner of VisiCalc's electronic sheet.

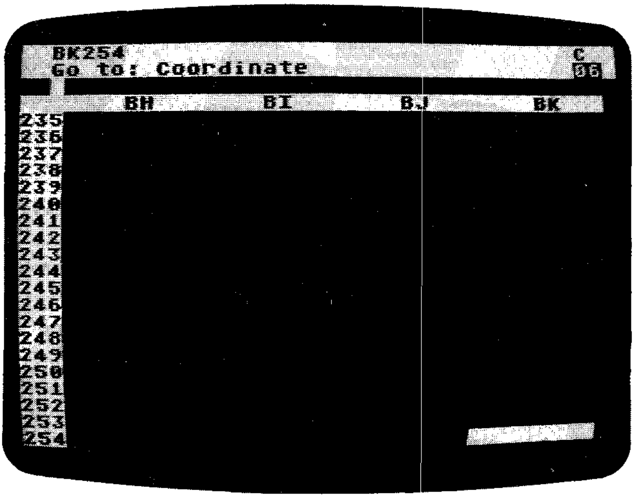
Direct Cursor Movement

Even with the aid of automatic repeat, it took a while to scroll the cursor and window all the way to the lower right corner of the VisiCalc sheet. There's an easy way to jump to another position on the sheet that takes only a few keystrokes.

Type the character > If you make a mistake, press the key labeled **BACK S** as many times as necessary to correct what you've typed. The next section, "Backing Up the Cursor," explains the use of this key in detail.

Two things will happen:

1) The message `GO TO: COORDINATE` appears on the middle line of the control panel just under the BK254 coordinate.
2) Directly below this message a small rectangle appears. You have discovered two new components of the VisiCalc control panel: the **prompt line** and the **edit line**.



Each time you press a key, VisiCalc prompt line tells you what you can type next. On screen above, the prompt line is telling you that (1) VisiCalc has recognized your keystroke command >, and that (2) it wants to know to what COORDINATE you want to GO TO. That means you must type in the letter and number of the position to which you want the cursor to move.

Press the **A** key once: The letter A will appear on the edit line (third line from the top of the screen), followed again by the small rectangle. Notice that you get a capital A, whether you press the shift key or not. VisiCalc knows that you are entering a coordinate and so takes care of upper case for you. The **SHIFT** key matters only when you press a key with two symbols on it, or, as you will see, when you are entering labels.

Press the number **1** key to move the cursor back to position A1. So far, we have A1 on the edit line followed by the small rectangle. VisiCalc is still waiting for you to type something. It doesn't know yet whether you want to go to position A1, or position A11, or A121, or some other position.

Press the ® key. The information on the prompt and edit lines disappears, and the cursor and window move back to the upper left corner of the sheet at A1.

Try another example. Press the keys >**C10** ® Note that the cursor now rests in mid-screen, directly below **C** and to the right of **10**. Coordinate C10!

Backing Up the Cursor

VisiCalc has several error correction features, each of which will be covered in this lesson. The first of these is the key labeled **BACK S**.

Press the following keys: >**A11** Then pause for a moment before pressing ® Suppose that you intended to move the cursor to position A1, but you accidentally pressed the **1** key twice. You now have A11 on the edit line, followed by the small rectangle.

Press the key marked **BACK S** once. Notice that the small rectangle "backs up" one character and erases the extra 1, leaving you with A1. Now press ® The cursor will move back to the upper left hand corner of the sheet.

In general, VisiCalc will let you correct typing errors by backing up with the **BACK S** key. You can also back up more than one character. As an example, let's change A11 to A2. Type >**A11** again. Press the **BACK S** key twice, backing up to leave just the letter A. Then press the **2** key to get **A2**. Press ® It works!

Besides backing up, you can "back out" with the **BACK S** key. Press the following keys: >**B5** Then pause. Suppose that you change your mind and decide that you don't want to move the cursor at all. Press the **BACK S** key once, and the number 5 will disappear from the edit line. Press the key again. The letter B on the edit line disappears and so does the prompt GO TO: COORDINATE. You have backed out of the > or GO TO command completely, and you can now type something else. By the way, the beep sounded to tell you that your original command had been canceled.

VisiCalc offers an even faster way to back out of a command. Press these keys: >**C12** Suppose you decide you don't want to use the GO TO command. Find the key labeled **BREAK** and put your finger on it. Watch the screen as you press the key. **BREAK** erased the prompt and edit lines. You have backed out of the GO TO command with one key, **BREAK**. No matter what you are typing, you can always back out and leave the sheet unchanged by pressing the **BACK S** key a few times or pressing the **BREAK** key once, as long as you notice your error before pressing the last keystroke of the command or hitting ®.

Before going on, spend a few more minutes moving the cursor around with the arrow keys, and the > or GO TO command. Try moving the cursor to a nonexistent position such as AB525. What happens? Try moving to an invalid coordinate such as 25A instead of A25. What happens?

Writing On the Electronic Sheet

As you have seen, moving the cursor and window around is pretty easy, but so far your electronic sheet is (or should be) empty. You'll find that writing on the sheet is even easier. Before proceeding further, type the following keys: **/CY** The screen will go blank, then reappear with the copyright on the prompt line and your VisiCalc serial number on the line below it. This command completely clears the sheet and repositions the cursor to position A1.

First we will label a row. Type the following keys (use capitalization if you wish): **SALES**

If you mistype a letter, you can back up with the **BACK S** key to back up and make changes in the SALES label.

Stop and look at the screen. On the prompt line is the word LABEL. This is VisiCalc's term for any type of message that won't be used in making calculations. On the edit line is the word SALES folowed by the small rectangle. The small rectangle indicates that you can still use the **BACK S** key to back up and retype the message or to back out completely. SALES also appears under the cursor highlight at position A1 on the sheet.

When you are satisfied, hold down the **CTRL** while you press the → key. The information on the prompt and edit lines disappears, and the cursor moves to position B1, leaving the label SALES at A1.

A typographical note: Throughout the rest of the Tutorial, all alphabetic characters will be shown upper case in the text. The photographs of ATARI screens will show the use of upper and lower case letters. You can use upper and lower case as you prefer for your own labels.

Now type the following keys: **100**

Stop and look at the screen. The prompt line says VALUE, which is VisiCalc's term for a number or formula. On the edit line is the number 100 followed by the small rectangle. Press the **BACK S** key four times, and watch the numbers disappear: first 0, then 0, then 1, then finally the prompt, VALUE. Position B1 is blank again. You could also have done the same thing by pressing **BREAK**

Now type in the following numbers: **75+25**

If you make a typing error, watch the edit line carefully and use the **BACK S** key to back up. Note, however, that the presence of the plus sign changes the results of using the **BACK S** slightly. If you try to erase just one numeric character after the plus, the entire number will disappear. The word VALUE is again on the prompt line, and the edit line reads 75+25 followed by the small square. Press the **SHIFT** and the **1** key together to type a **!** (the exclamation point).

Instantly, 75+25, has been calculated to show 100 (the answer) on the edit line. You can use this "exclamation key" feature to perform quick calculations before writing a number on the sheet. Much more will be said about formulas and calculations later.

Notice that nothing has appeared under the cursor highlight at B1. Everything has happened on the edit line. Now press ® The information on the prompt and edit lines disappears, and the number 100 appears at position B1 on the sheet. Pressing ® caused another change on the screen.

The top line of the screen now reads: B1 (V) 100. This line is called the **entry contents line** because it gives the full explanation of the contents written in the entry position highlighted by the cursor. Right now, the entry contents line says (V) for VALUE and shows the number 100.

Try pressing **BACK S** Nothing happens. Pressing ® told VisiCalc to consider 100 an actual entry. Press the ◀ key, and the cursor will move back to position A1. If you neglected to hit **CTRL** too, you got A+ on the edit line and VALUE on the prompt line. Press **BREAK** to erase your error before continuing. Assuming a correct entry, the entry contents line reads A1 (L) SALES. The (L) stands, of course, for LABEL.

Formulas and Recalculation

Move the cursor to position A2 by pressing the ▼ once. Next type the letters **COST** and then press the ▶ key. The cursor moves to B2, leaving the label COST at A2. Note that use of the arrow key after an entry not only moved the cursor to the next position, but also entered your label just as if you had typed a ® before typing ▶.

We're getting ready to write a formula at a coordinate (B2). We want the entry at position B2, for COST, to be 60% of the number for SALES or .6 times 100. Instead of typing the 100, however, we'll use its coordinates. Press the following keys:
.6*B1

The * symbol is used to indicate multiplication. The edit line should display

.6*B1

If it doesn't, use **BACK S** to correct any error. The formula is telling VisiCalc to multiply whatever is at coordinate B1 by .6. Assuming that you are satisfied, press ® and watch what happens.

The information on the prompt and edit lines disappears. You should now see

B2 (V) .6*B1

on the entry contents line. And at position B2 is the number 60, the result of multiplying .6 times 100, the number at B1.

Let's take a quick peek at VisiCalc's power. Press the ▲ key to move the cursor up to position B1. Now type **200** ® and watch the screen. The number behind the cursor highlight at B1 changes to 200 because you entered the number 200 at B1, effectively erasing the earlier number (100). What else happened?

Press the ▼ key, moving the cursor to B2. On the entry contents line at the top of the screen, the formula you had typed earlier, .6*B1, is still there. When you changed the number at B1 to 200, VisiCalc automatically recalculated the formula at B2 as .6*200, or 120. Notice that COST is still 60% of sales. You'll see many more examples of this powerful recalculation feature as we progress.

More on Labels and Values

Let's look more carefully at LABEL and VALUE and explore an even simpler way to write formulas. As an example, we're going to write a formula that calculates gross profit by subtracting cost from sales. First, we need to get the cursor into position to write a new label. Press the following keys: >**A3**® to move the cursor to coordinate A3.

To write the label GROSS, press the **G** key. Notice that the prompt line immediately says: LABEL. When you write at an entry position, VisiCalc looks at the first key you press to determine whether you are typing an alphabetic LABEL or a numeric VALUE. If you start with one of the letters A through Z, as you did here, VisiCalc assumes that you are typing a Label.

If you start with one of the digits 0 through 9 or a decimal point. ".", or with something that could begin a formula such as plus, "+", minus, "−", open parenthesis, "(", or "@" or "#" (which will be explained later), VisiCalc assumes that you are typing a VALUE. For now, press **BREAK** to back out of LABEL.

What happens if you want to write a message such as −GROSS− or 1ST QTR? Try typing in **−GROSS−** and watch what happens.

VisiCalc takes the initial dash or minus sign to mean that you were typing a formula, the letter G as part of an entry position coordinate and then complained as you typed something that couldn't be a formula. Press **BREAK** to erase this entry.

In order to use a numeric symbol in a LABEL, we need to place a quotation mark at its beginning. Type a " by holding down the **SHIFT** key while typing the **2** key. VisiCalc takes the " to mean that you want to type a LABEL. The quote symbol will not, however, be a part of the message itself. As soon as you press the " key, the prompt line says LABEL, but does not show a character. The edit line only shows the small rectangle. Now you can type: **–GROSS–**

Do not use a closing quote symbol unless you want it as part of your LABEL. If you ever want to begin a LABEL with a quotation mark, you will have to type " twice. Now press the ➧ key. The cursor moves to position B3, leaving the message —GROSS— at A3.

Now we're ready to calculate SALES minus COST. The formula you'd expect would be B1–B2. What will happen when you type B1–B2?
Try it. Type **B1–B2**

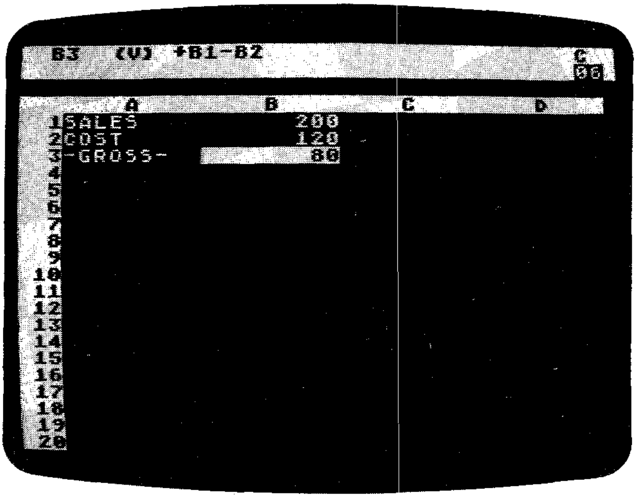
VisiCalc accepts this formula, so press ® What happened? If you've been watching the prompt line, you already realize that VisiCalc took the initial letter B to mean that you were entering a LABEL or message. B1–B2 is a perfectly legitimate message or comment, but it doesn't calculate anything. Only a VALUE can calculate.

Try again. First, we'll eliminate the erroneous message B1–B2. Try pressing **BACK S** and then **BREAK** Nothing happens because you've already pressed ®. To erase an entry after a carriage return, you must use the VisiCalc command that blanks out entry positions.

Press the following keys: **/B**® The message B1–B2 under the cursor highlight disappears, and the entry contents line goes blank except for the cursor coordinate B3. Note, however, that in most cases where you want to enter new information in a previously used coordinate, you can simply type in the new LABEL or VALUE without first blanking out the coordinate.

Remember that we used the " key to type a LABEL when VisiCalc would otherwise have tried to treat it as a VALUE. We can use a similar trick to type the formula B1–B2 as a VALUE, instead of a LABEL. One way to do this would be to type the formula as 0+B1–B2. VisiCalc would take the initial digit 0 to signify that we were typing a VALUE.

An equivalent formula is +B1–B2. VisiCalc will take the "+" to indicate a VALUE. Press the following keys: **+B1–B2** ® The entry contents line displays our formula as a VALUE: B3 (V) +B1–B2. The cursor highlight rests on the number 80, the result of calculating +B1–B2, or +200–120.



Cursor Moves in Formulas

So far, you know how to move the cursor to an entry position, and write a message, a number, or a formula that refers to other positions on the electronic sheet, such as +B1–B2 in the previous example. By now you probably also realize that if you change the numbers at B1 or B2, the formula +B1–B2 at entry position B3 will be recalculated, and the new result will be displayed at B3.

As you wrote the formula for SALES minus COST, you probably had to check the screen to see that the number for SALES was at position B1, and the number for COST was at B2. Now imagine that you have already written a large number of formulas on the sheet.

Keeping track of which numbers were at which coordinates would become time-consuming. Columns A and B might have scrolled off the left edge of the window as you moved it to display other parts of the sheet. Then you wouldn't even be able to see the numbers next to SALES and COST, so writing a new formula involving SALES and COST might be a problem. There's an easy way to solve this problem. You write the formula, but let VisiCalc fill in the coordinates! Let's try it.

Press the + key. The prompt line reads VALUE, and the "+" appears on the edit line, followed by the small rectangle. At this point, we would normally type the coordinate B1, but what we really want is the number next to the label, SALES, at coordinate B1 (currently 200). Point at that number on the screen with your finger. We are about to do the same thing electronically by "pointing" with the cursor.

Watch the edit line and press the ▲ key once. The cursor moves up to highlight the number 120, and the coordinate of that number, B2, appears on the

edit line. Now press ▲ again. Do you see what we mean by "pointing" the cursor? You have taken the cursor from its starting position at B3 and pointed it to B1 by placing it on B1.

The edit line now reads +B1 followed by the small rectangle. Notice that these are first three characters of the formula remaining on the entry contents line that you typed in earlier.

Press the — key. The cursor jumps back to B3, the entry position at which we began writing the formula. The edit line now reads +B1— followed by the little rectangle. As a general rule, after pointing the cursor at the position you want to include in the formula, you simply continue the formula by typng an arithmetic operation symbol such as —, +, *, or /.

Watch the edit line again and press the ▲ key once more. The cursor moves up to 120, the number next to COST, and the edit line now reads +B1—B2, exactly the same formula as displayed on the entry contents line. This is the formula we want!

To enter the formula as it stands on the edit line, press ® The information on the prompt and edit lines disappears.

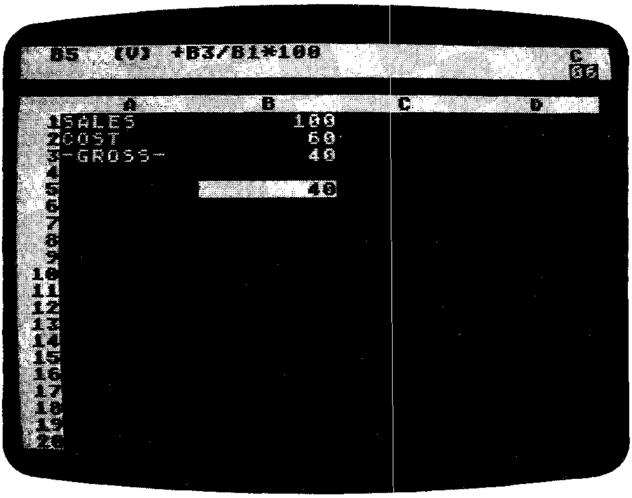
You can see that the results of pointing to coordinates with the cursor are just the same as typing those coordinates in directly from the keyboard. The entry contents line still reads B3 (V) +B1—B2. The number on which the cursor rests is 80, the result of calculating B1 minus B2.

To demonstrate VisiCalc's recalculation feature again, press the ▲ key twice to move the cursor up to B1, and change the number there by typing: **100** ® Notice that B2 changes back to 60, or .6 times 100, and B3 changes to 40, or 100—60.

As a general principle, remember that whatever you see on the edit line you can type in from the keyboard. Likewise, any number or entry position currently on your sheet can be pointed to instead of typed. As you gain experience and familiarity with VisiCalc, you'll find that the technique of moving the cursor to the positions you want will become easier. In time, you'll find that you can almost forget about coordinates entirely and think only in terms of the visual positions of numbers and formulas on the sheet.

To test your understanding of the process of moving the cursor as you write formulas, you may wish to try an example yourself. Move the cursor down to position B5 and write a formula there for gross profit as a percentage of sales. Hint: the desired formula is +B3/B1*100. Try to obtain this formula by moving the cursor and typing the + and / keys.

Your screen should look like the photo below. After you have obtained the result (40), keep the cursor at B5 and type /**B**® Then type >**B1**® to place the cursor at B1.



Saving the Electronic Sheet On Diskette

Begin by taking out one of the diskettes that you initialized earlier. You are going to save the information you have just developed on the electronic sheet. In this way, you can use your work as we begin Lesson Two by loading your sheet back into the computer.

If you skipped the discussion of diskette initialization when you read Part I, the Introduction, you can still initialize a diskette now. The /SI command won't disturb the information you have written on the electronic sheet.

Take out a blank diskette or a used diskette that you feel free to erase and carefully follow the instructions under "Initializing VisiCalc Storage Diskettes," then continue with the instructions below.

If you don't have any extra diskettes, it's okay. Lesson Two gives brief instructions for setting up the electronic sheet with exactly the same labels, numbers and formulas which you have now. We do recommend, however, that you skim over the material below and at the beginning of Lesson Two on the /SS and /SL commands.

To begin, make sure that your disk drive 1 BUSY light is off and open the drive door by pushing in on the button at the bottom of the drive door. If your VisiCalc program diskette is still in the drive, carefully remove it, put it back in its paper sleeve, and replace it in the front pocket of the VisiCalc binder.

Insert the blank diskette into the drive just as you did before. Gently push the diskette all the way in and close the drive door by pushing it down until it clicks shut.

Now type **/S** the VisiCalc STORAGE command. The prompt line should read

`STORAGE: L S D I Q #`

VisiCalc is telling you that it recognizes /S as the storage command, and that it expects you to choose from one of six forms of the storage command by pressing one of these keys: **L S D I Q #** These keys have the following meanings:

L	Load the sheet contents into RAM memory from a diskette file.
S	Save the sheet in memory by "writing" it into a diskette file.
D	Delete a previously saved file from its place on the diskette.
I	Initialize, or format, a blank diskette.
Q	Quit the VisiCalc program.
#	Save or load a sheet in the Data Interchange Format (see Part III, the STORAGE Command).

Press the letter **S** and `FILE FOR SAVING` appears on the prompt line with the little rectangle on the edit line. Because each diskette has enough room to hold several electronic sheets, you must give each sheet on the same diskette a unique name. In this way, you can find the sheet at a later time and load it back into the computer.

The saved information is called a diskette **file**, and the name that identifies the file is called a **file name**. Because we've been studying an example, let's save our work with the file name, EXAMPLE. VisiCalc will find an empty area on the diskette and will write the sheet contents there. VisiCalc will also save the file name and a record of where it saved the sheet contents in a special area on the diskette called the directory.

Finally, it appends a suffix, **.VC**, on the end of the file name. After saving EXAMPLE it will be called EXAMPLE.VC.

There are a few simple rules for creating a valid file name. A file name can be up to eight characters in length (either letters or number). The first character, however, must be a letter. The space character and all punctuation and control characters are not allowed.

If you have more than one disk drive, you must add a **prefix** to the file name. The prefix tells VisiCalc the drive in which your storage diskette is located. You indicate the drive by typing the letter D, the drive number, and a colon. For instance, if the diskette were in drive 2, the correct prefix would be D2:

Once you name a drive other than drive 1, VisiCalc saves your sheets to and loads them from that drive and ignores drive 1. For example, if you have designated drive 2 (with D2:), you can use the /SS command to store your sheets without having to type in the D2: prefix. In this case, drive 2 is said to be the "default" drive. To return the default condition to drive 1, use the D1: prefix with the /SS or other storage commands. For more information on device prefixes and file suffixes, read the File Name section in the STORAGE command reference, Part IV.

Let's go ahead and name the file we are saving EXAMPLE. Place the blank, initialized diskette you're going to use in drive 1. We want to tell VisiCalc to save the file on the diskette in that drive. Type in the file name **EXAMPLE** As usual, you can correct typing errors with the **BACK S** key. When you are satisfied, press ®

The disk drive should begin whirring and the BUSY light should come on. After a moment, the drive should quiet down, the BUSY light will go off, and the prompt and edit lines will go blank. Your work is safely filed away on the storage diskette.

This completes Lesson One. You may wish to experiment for a while, moving the cursor around and writing your own labels, numbers and formulas. Try writing some formulas by pointing the cursor to obtain the coordinates. VisiCalc has many more features we haven't discussed yet, and you may stumble upon one of them. If something happens that you don't understand, make a note of it and then continue with the next lesson. Most of your questions will be answered as you go. You already know enough about VisiCalc to use it for some simple applications. Try it!

Postscript: Protecting Your Work

Have you ever worked out a problem or made some notes to yourself on a sheet of paper only to find out later that the sheet had been lost or that someone had accidentally thrown it away? Or perhaps you've lost the results of some calculation you were performing on an electronic calculator because power was turned off or the battery died. Things can and do go wrong.

As you begin to use VisiCalc, you'll find that at times the results you see on the screen may be quite important to you. Losing that information at the wrong time would be at best a real nuisance, and at worst, something of a disaster. How can you protect yourself against such losses?

Save Your Work As You Go

VisiCalc does its best to protect you. For example, if you give the command to clear the screen (intentionally or accidentally) by typing **/C** VisiCalc will display `CLEAR: Y TO CONFIRM` on the prompt line. Only if you type the letter **Y** at this point will the contents of the sheet be erased. If you type any other key, the clear command will be aborted, and the sheet will be left unchanged. Similarly, if you type **/B** to blank out an entry, nothing will happen until you press one of the keys: → ← ↓ ↑ or ®. Any other key will abort the BLANK command.

However, things beyond VisiCalc's control can go wrong. What if your building has a power failure? What if someone pulls the plug from the socket? What if you are called away by some emergency, and the janitor turns off your computer?

To protect yourself, you should save the electronic sheet periodically on diskette. As you work, think of how long it has been since you last saved the sheet. If you have spent more time than you would wish to lose if something went wrong, or if you have new results which might be difficult to reconstruct, then it's time to save the sheet again.

To keep track of several versions of the same information on diskette, you can append a sequential number to the file name you use when you save the sheet. Thus, the file name, FRCAST1 might become FRCAST2. Remember that only eight alphanumeric characters are allowed for the file name.

Making Backup Copies of Diskettes

Saving your work periodically on diskette is only the first step in protecting yourself. A diskette is a safe and reliable medium for storing information. However, a diskette can be harmed even in ordinary use. A diskette may be scratched, or it may pick up grease or dust. It may be damaged by heat, exposed to a magnetic field, or accidentally be re-initialized, thus erasing its contents. And a diskette will eventually wear out. Its average lifetime is about 40 hours of use (whenever the BUSY light is on, the diskette is in use). To protect yourself, you should always make extra copies of your important files on separate "backup" diskettes.

To make a backup copy of your files, you can use VisiCalc's STORAGE command. Simply insert the diskette containing the file you want to copy into the disk drive 1, and use the /SL command to load the sheet from the diskette file into memory. For details on the /SL command, see Lesson Two and the STORAGE Command in Part III. Then insert an initialized storage diskette into drive 1 and use the /SS command to save the same information on the new diskette. The time it takes to make backup files will be amply repaid the first time you try to load a file from a diskette, only to get the message that an error occurred while trying to read the disk.

Alternatively, you can copy the entire contents of one diskette to another diskette. To do this, you must use programs that are provided with the Disk Operating System (DOS) for your ATARI 810 floppy disk drive. Read the DOS manual that comes with your disk drive carefully and follow the directions on the duplication procedure.

Test your understanding of the procedures on a data diskette you make expressly for experimentation. Until you thoroughly understand the procedures, don't risk using diskettes with important data on them; you may lose the data while learning.

Making backup files is important. It's all too easy to read about these protective measure, use them once or twice, and then when you're in a hurry, skip the backup steps.

Remember Murphy's Law: If anything can possibly go wrong, it will. Protect yourself.

Lesson Two

Lesson Two

In this lesson, you will learn how to extend the basic principles behind VisiCalc learned in Lesson One by applying them with new commands. We will begin with the example built up in Lesson One, showing a figure for SALES, and formulas to calculate COST of goods sold and GROSS profit.

If you have just finished Lesson One, everything you need should still be present on the electronic sheet. Check your screen against the screen photo below, and continue with the text from that point. If you want to practice loading the sheet you just saved anyway, type **/CY** and then follow the instructions in the next section.

If you're tackling Lesson Two in a new session, your first step is to load the VisiCalc program into your computer's memory. The instructions to do this are in Part I in the section entitled "Loading VisiCalc."

If you saved the results of Lesson One on diskette, you can easily reload the same information by following the instructions below.

If you didn't save EXAMPLE on diskette, you can type it in. To practice moving the cursor as well as the writing labels, numbers, and formulas, you can go through the steps in Lesson One. Or you can type exactly the characters you see below. Remember you may have to use the **SHIFT** key to type some of the characters.

>**A1®**
SALES→100®
>**A2®**
COST→.6*B1®
>**A3®**
"–GROSS–→+B1–B2®
>**B1®**

Compare what you have on your screen with the photo below. If everything looks fine, go ahead with the next section, "Replicating a Formula."

Loading the Sheet from Diskette

Make sure that your disk drive's BUSY light is off, then open the drive door and (if you haven't done so already) carefully remove your VisiCalc program diskette and replace it in the pocket on the inside front cover of this manual. Take out the storage diskette onto which you saved the file, EXAMPLE.VC and insert it into drive 1. Be sure that the label on the diskette jacket is up and on the side of the diskette nearest you. Gently push the diskette all the way in, and close the drive door.

Now type the VisiCalc STORAGE command **/S**. The prompt line reads

`STORAGE: L S D I Q #`

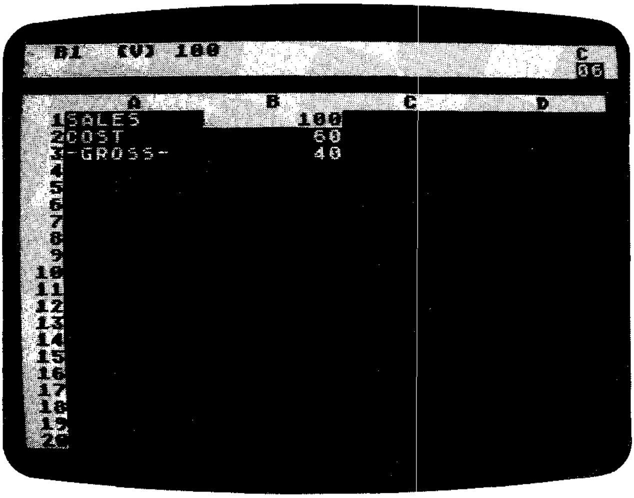
To review the meanings of the characters L S D I Q #, check the section entitled "Saving the Electronic Sheet on Diskette" at the end of Lesson One.

Press **L** The prompt line reads `FILE TO LOAD`. At this point, you could simply type the name EXAMPLE, ending with the ® key. But let's try something else. We will **scroll** the file names from the storage diskette.

Press the ▶ key once (don't forget to hold down the **CTRL** key while you do). Your disk drive will whir for a moment as VisiCalc looks at the directory and the BUSY indicator lights on each drive will come on. Then the name EXAMPLE.VC will appear on the edit line. Note that VisiCalc has appended the .VC suffix. If a different name appears, press the ▶ key repeatedly until you get the name EXAMPLE.VC.

If the file you're looking for is not on the diskette, you will eventually scroll through all the file names on the diskette and out of the **/SL** command. For more information on the scrolling, look up the File Name section of the STORAGE command Reference.

Assuming that you have the name EXAMPLE.VC on the edit line, press ® Watch the characters flashing by at the left end of the edit line. These are equivalent keystrokes to the ones you would type from the keyboard to set up the sheet. VisiCalc automatically "types" them in at high speed as they come back from the diskette. Once the loading process ends, your screen should resemble the photo below.



Replicating a Formula

Your screen should look exactly like the one pictured above. The cursor should be at B1. If not, type >**B1**® Further, if the number at B1 is not 100, just type **100** and press ®

At present, we have figures for sales, cost of goods, and gross profit for only one month (or year, or other period). Now, we'll project these figures out for twelve months.

Let's begin by assuming that SALES will increase by 10% each month. Press the ▶ key to move the cursor to C1 and type: **1.1*◀®**

Notice that we used a cursor movement to fill in the coordinate B1 in the formula for the next month's sales. The entry contents line at the top of the screen now reads

```
C1 (V) 1.1*B1
```

and the number under the cursor at C1 is 110, or 1.1*100.

To calculate sales for the remaining ten months, we would have to move the cursor to D1 and type the formula 1.1*C1, then move on to E1 and type 1.1*D1, and so forth. Since this is such a common operation and it requires so many keystrokes, VisiCalc provides a shortcut.

That shortcut is the REPLICATE command, and it can be used to make copies of, or to "replicate" formulas, labels, numbers, blank entries, etc. across columns, down rows and so forth. In this lesson, we'll use the replicate command in just a couple of simple examples. The many uses of this command are covered more fully in Lesson Three.

With the cursor at C1, type **/R** to enter the REPLICATE mode. The prompt line reads `REPLICATE: SOURCE RANGE OR RETURN`, and the edit line `C1`, the coordinate of the formula on which the cursor rests, followed by the small rectangle. Because you're going to use only one formula as your source (not a range of formulas), press ® to select C1 as the single item to be replicated.

The prompt line now reads `REPLICATE: TARGET RANGE` and the edit line reads

```
C1 . . . C1:
```

followed by the small rectangle. Since you've told VisiCalc that you want REPLICATE the formula at C (with the **/R** command), it needs to know *where* (the "target range") you would like it replicated (copied) on the electronic sheet.

Our intent is to project sales out for twelve months. The first month is shown at B1, the second at C1, and the twelfth month will be at M1. Hence, we want the formula replicated in the target range of positions from D1 to M1.

Press the ➧ key to set the beginning of your target range at D1. Now type a period to tell VisiCalc that the next coordinate will be the second part of your target range. If you don't type the period, every use of the ➧ will simply create a new target start entry, instead of extending the ending coordinate of the target range. The period both acts as a delimiter and produces three periods following D1. The edit line now reads

```
C1 . . . C1: D1 . . .
```

As you can see, by moving the cursor, we are indicating where we want copies of the formula to be placed. Now press the ➧ key ten times (until the cursor rests beneath M1). Notice that as you move the cursor to D1, E1, F1, and so on, the "target range" on the edit line reads

```
D1 . . . D1, D1 . . . E1, D1 . . . F1,
```

and so on. VisiCalc is "filling in" the ending coordinate of the target range, just as it did when we moved the cursor in the middle of typing a formula.

When you have finished pressing ➧ key ten times, the cursor will be resting at M1, and the edit line will read

```
C1 . . . C1: D1 . . . M1
```

If you moved too far with the →, you can move back with the ←. Now press ®. The cursor jumps back to C1, where the original formula is stored. The edit line reads

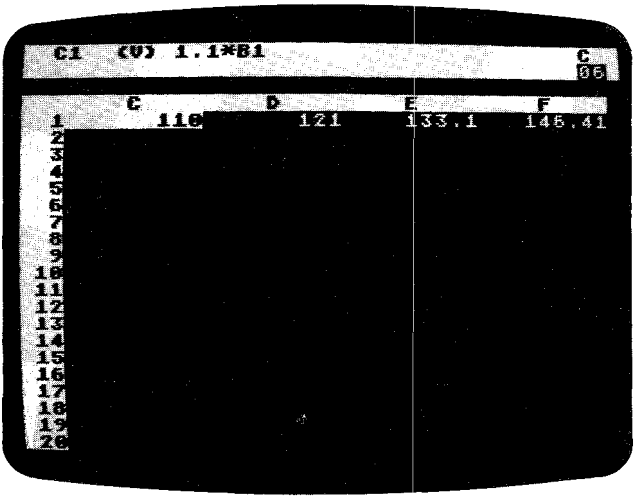
```
C1: D1 . . . M1: 1.1*B1
```

The small rectangle is highlighting the coordinate B1 on the edit line. The prompt line reads

```
REPLICATE: N=NO CHANGE, R=RELATIVE
```

VisiCalc is asking whether we want the same formula, 1.1*B1, at each of the positions in the target range D1 . . . M1, or whether the coordinate B1 should be interpreted as *relative* to the position of the formula.

We want to show sales increasing by 10% in each month, so we want the formulas to be 1.1*B1, 1.1*C1, 1.1*D1, etc. In other words, we want the formula to be relative; each new sales figure should be 1.1 times the previous month's sales. Press the letter **R** and watch the screen. The information on the prompt and edit lines disappears. The cursor remains at C1, where we started, and numbers appear in the visible columns.



Use the → key to move the cursor to D1, E1 and F1, and notice what appears on the entry contents line: 1.1*C1, 1.1*D1, and 1.1*E1. Press the → key seven more times to move the cursor over the entries G1 through M1, scrolling the window to bring them into view. VisiCalc has "typed" the formulas for you, and calculated the sales values for all twelve months. At M1, the twelfth month's sales should be shown as 285.3117 (to four decimal places).

VisiCalc offers many more options for the replicate command, and we will cover these in succeeding chapters. For the present, however, remember these five easy steps for replicating a formula:

1) Point the cursor at the entry position you want to replicate.
2) Press **/R** to start the replicate command.
3) Press ®

4) Point the cursor at the first entry position in the range of positions where you want the formula replicated, press . and point to the last entry position (or you can type in the entry coordinates).
5) For each coordinate in the formula, press either N or R depending on whether that coordinate should be left unchanged, or interpreted as relative to the position of each copy of the formula.

Replicating a Range of Formulas

Type >**A2**® to scroll the window all the way back to the left edge of the sheet, and then press ▸ to move the cursor to B2. To complete our twelve month projection, we would like to replicate the formulas for cost of goods sold and gross profit. At the moment, the entry contents line shows the formula for cost of goods, .6*B1. If we were to move the cursor to B3, we would see the formula for gross profit, +B1−B2. Our next project is to replicate both of these formulas across the sheet simultaneously.

Press /**R** The prompt line reads

```
REPLICATE: SOURCE RANGE OR RETURN
```

and on the edit line is B2, followed by the small rectangle. If you were to press ® at this point, as we did before, you would replicate just the formula for cost of good sold at B2. When you were finished, you would come back to the formula for gross profit at B3 and replicate it into the same range of columns as you did for B2. We can accomplish both of these steps at once: Type **.B3**® The edit line now reads

```
B2 . . . B3:
```

VisiCalc acknowledges that we want to replicate a "source range" of formulas, B2 through B3, instead of just hitting ® to indicate use of single formula shown on the edit line. The prompt line reads

```
REPLICATE: TARGET RANGE.
```

Instead of pointing at the first and last positions as we did before, we will type the coordinates of the target range. Type **C2.M2**®

For a source range of B2 . . . B3 and a target range of C2 . . . M2, VisiCalc will assume that the formula at B2 (for cost of goods) is to be replicated at positions C2 through M2, and the formula at B3 (for gross profit) is to be replicated at positions C3 through M3. In other words, we must enter each range (for row 2 and for row 3) separately.

The prompt line now reads

```
REPLICATE: N=NO CHANGE, R=RELATIVE
```

and the edit line reads

```
B2: C2 . . . M2: .6*B1
```

with a highlight over the coordinate B1. Do we want the formula at coordinate B1 to be interpreted as "absolute" (N) or as relative (R) to each month's sales? Our intent is that cost of goods sold in any given month will be 60% of that month's sales.

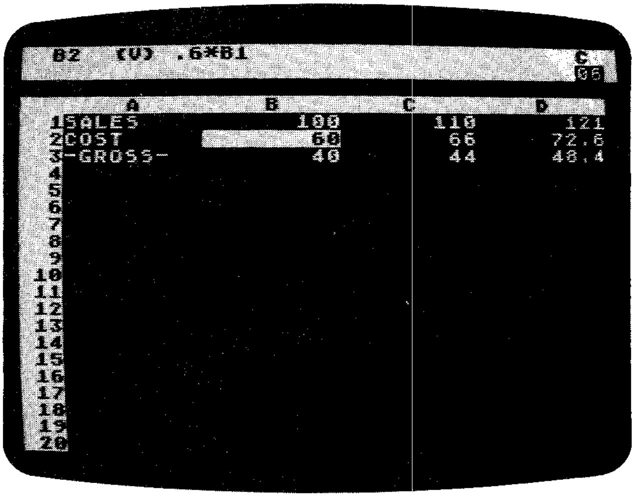
Hence we want B1, the coordinate for SALES, to be interpreted as *relative* to the position of each copy of the formula. For the formula at B2, we want the sales figure just above it, or B1. For the formula at C2, we want the sales figure just above *it* or C1; and so on.

Press the letter **R** Almost instantly, numbers appear in the other columns, and the edit line now reads

```
B3: C3 . . . M3: +B1
```

with a highlight over B1. VisiCalc is ready to replicate the formula for gross profit, at B3, into positions C3 through M3. The +B1 is the beginning portion of the formula +B1−B2. Again, we want B1 to be interpreted as relative to the position of each copy of the formula.

Press the letter **R** again. Now the rest of the formula appears on the edit line, as +B1−B2, this time with a highlight over B2. B2, or cost of goods, is also relative in the gross profit formula. Press **R** once more. Numbers will appear in the other columns of row 3, and the prompt and edit lines will go blank. The REPLICATE command has finished its work.



Use the arrow keys to move the cursor to the right and up and down to examine the formulas and calculated results displayed in columns C, D, E and so on. Finally, type >**M1®** to get to the last month's sales, cost of goods and gross profit, in column M. VisiCalc has saved you a good deal of work already. But these numbers are somewhat hard to read, because they fill the columns and don't always line up. Can we do better than this?

Formatting the Screen Display

Of course. In fact, we can change the whole sheet (a "global" change) to an integer format. Type /**GFI** (for "Global Format Integer"). If you scroll the

window to the left, you will see that all of the numbers that come into view on the screen have been rounded to integers and aligned to the right side of each column.

However, this does not mean that VisiCalc has actually rounded the numbers that it uses in its calculations. Each number is calculated and maintained with up to eleven significant digits or decimal places (so that, for instance, each new period's sales is based on an accurate rendition of the previous period's sales). The numbers are rounded *only* as they are displayed on the screen.

Perhaps you'd prefer to see two more decimal places, for "dollars and cents." Press / the keystroke which starts all commands. The prompt line reads

`COMMAND: BCDFGIMPRSTVW-`

Each of the keys, B, C, D, and so on through "–" is a keystroke for a different command.

So far, we have seen the commands /B (for BLANK), /C (for CLEAR), /R (for REPLICATE), and /S (for STORAGE). Now, press **G** The prompt line reads

`GLOBAL: C O R F`

VisiCalc has recognized the GLOBAL command, which is used to change something about the entire screen display. Next, VisiCalc expects one of the keystrokes C, O, R, or F. Press **F** Now the prompt line reads

`FORMAT: D G I L R $ *`

VisiCalc is ready to change the screen format (the way in which numbers and labels are displayed on the screen) over the entire sheet.

A moment ago, you used the letter **I** to change all of the numbers to integer format. Now press **$** (don't forget to use the **SHIFT** key). And remember, you can use the **BACK S** key to correct typing errors or the **BREAK** key to quit the command and start over. Notice how the screen display changes to show everything in dollars and cents form.

As you might guess from the FORMAT prompt list (D G I L R $ *), VisiCalc offers ways to format numbers and alphabetic labels. You can, for example, set the format of each entry position individually, instead of globally. These options will be covered more fully in lessons Three and Four of this Tutorial.

Fixing Titles In Place

If the cursor is not on M1, type >**M1®** Only the numbers for each month's sales, cost of goods and gross profit are shown on the screen. The titles SALES, COST, and –GROSS– have scrolled off the screen window to the left. Imagine the situation if you were preparing a more complex income projection, with many rows of numbers for selling and administrative costs, taxes, and so on. It would be difficult to remember what each row of figures represented, once the titles had scrolled off the screen. So, let's look at a way to keep our left edge titles visible, no matter how far we scroll to the right.

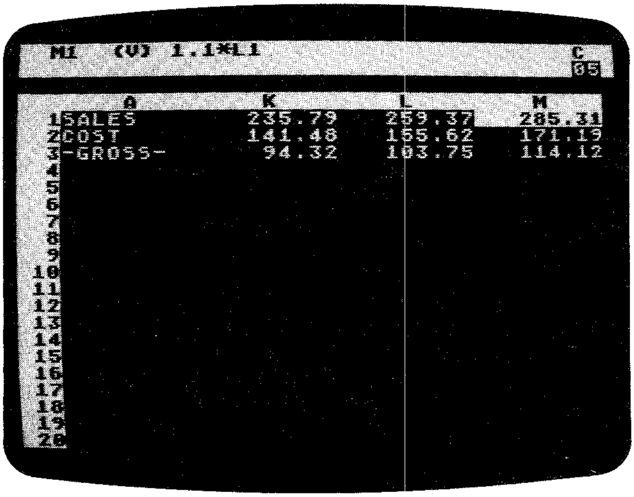
First, put the cursor back to the left edge, where the titles are. Type >**A1®** to bring the titles SALES, COST, and –GROSS– into view. Now, invoke the TITLES command by typing **/T** The prompt lines says `TITLES: H V B N`. The possible keystrokes are:

- **H** To fix horizontal titles.
- **V** To fix vertical titles.
- **B** For both horizontal and vertical.
- **N** For neither.

Press the letter **V** to tell VisiCalc to fix the vertical column A, where the cursor lies, in its present position, as the left hand column of the screen. Press the → key eight times, and watch the screen.

Notice that column A stays fixed in place while the remaining columns scroll to the left, disappearing when they reach column A.

Now press the ← key nine times. If you aren't sure of what happened, press the ← key again. You are "bumping" into column A, just as you bumped into the left edge of the sheet earlier. Next, type >**M1**® Column A is still visible, making it easy to identify each row of numbers.



Now For a Quick Recalculation

So far, with the aid of the REPLICATE command, you have written one number (the beginning number for SALES at B1), and thirty-five formulas on the electronic sheet. How are these formulas related? Press >**B1**® to bring the first columns into view, leaving the cursor on the initial SALES figure.

The formula for COST at B2 is .6*B1, which depends on the figure for SALES at B1. The formula for gross profit at B3, in turn, depends on both SALES and COST (+B1−B2). What about succeeding columns? At C1, the formula is 1.1*B, so this entry also depends on the initial SALES figure. And cost of goods at C2 depends on the figure at C1, while C3 depends on both C1 and C2. At D1 we have 1.1*C1, and so on.

As you can see, a change to the initial SALES figure at B1 will affect every other number on the sheet. Try it. Just type a new number, such as 123.45, and press ®. How long did it take to recalculate twelve months' worth of sales, cost of goods and gross profit formulas? Type **100®** again, and watch the changes ripple through the other figures on the screen. Scroll the screen window to the right to view M1, the ending month's sales.

At this point, you might be wondering how to change the percentages themselves—sales growth figure of 10% or the cost of goods percentage of 60%—to recalculate gross profit. For simplicity's sake, we've designed this example so that the only changeable figure is the initial SALES. Since the figures 1.1 and .6 are built into each of the twelve formulas for sales and cost of goods, we can't change these percentages without replicating all of the formulas again.

A better approach would be to write the factors 1.1 and .6 into separate positions on the sheet, and make the sales and cost of goods formulas refer to these positions. If we did this, changing the sales growth and cost of goods percentages would be as easy as changing the initial sales. We'll make use of techniques like this in Lesson Three in an example related to personal budgeting.

Adjusting Column Widths

For some time now, you've been scrolling the window back and forth across the sheet to view the figures for different months. You might be wishing for a larger screen that would display more columns at once. Type **>B1®** to return the cursor to coordinate B1.

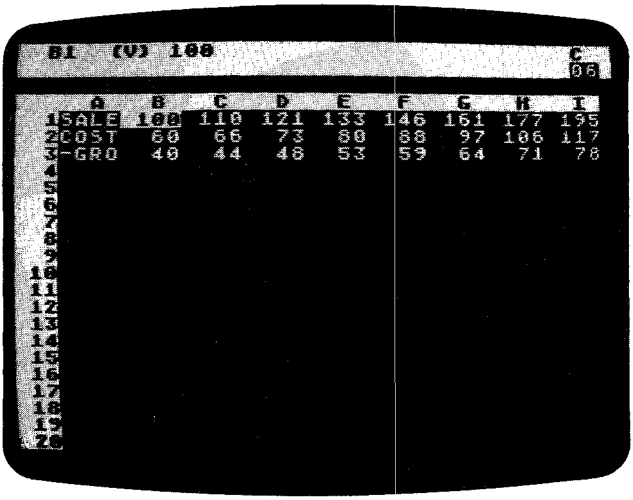
Type another GLOBAL command this time for a Column width of 7 characters: **/GC7®**. In an instant, the screen changes to display more columns. Each column has been narrowed from nine characters to seven characters in width.

In general, you can use the command /GC to set the "global column width" to anywhere from 3 to 37 characters per column. Given a column width, VisiCalc will fit as many columns as it can across the screen. Note that you can only set column widths **globally**, not individually.

Right now, the dollars and cents figures just about fill up the available space in these 7-character columns. Type **/GFI** to round these numbers to integers. Now that we have some extra space, we can narrow the columns further.

Type **/GC4®** That gives us even more columns of figures in the window, with each column being four characters wide and displaying three digits.

VisiCalc leaves an extra character blank to the left of each value. This "reserved" space has been included to keep the display from running large values together. Labels, however, do not have this extra space.



Look at the titles, SALES, COST, and –GROSS– in column A. SALES has been shortened to SALE and –GROSS– is now –GRO. Have we lost the rest of the labels SALES and –GROSS–? Type >**A1**® to move the cursor to position A1 to find out (if you press the ← key, you'll bump into column A, which we fixed as a title area).

Note that though the label at A1 still reads SALE, the entry contents line above reads A1 (L) SALES. Press the ↓ twice to reach A3. The entry contents line again displays our true label

A3 (L) –GROSS–

Even though the columns have been narrowed, the full alphabetic labels are preserved.

These labels can be more than nine characters long. In fact, you can type an alphabetic label as long as you like, regardless of the current column width, and the full label will be preserved. Try this: with the cursor still at A3, type **GROSS PROFIT** Then press the ↑ key to move up to COST, and type **COST OF GOODS SOLD** followed by ® Next type /**GC12**®

Notice that the entire label GROSS PROFIT comes into view, and the number of columns in the window is reduced. Now type /**GC18**® Notice the prompts GLOBAL: C O R F and COLUMN WIDTH and the small rectangle on the edit line as you type. As usual, the **BACK S** key can be used for corrections as you enter the number 18. The entire label COST OF GOODS SOLD can be seen. Let's go back to /**GC7**®

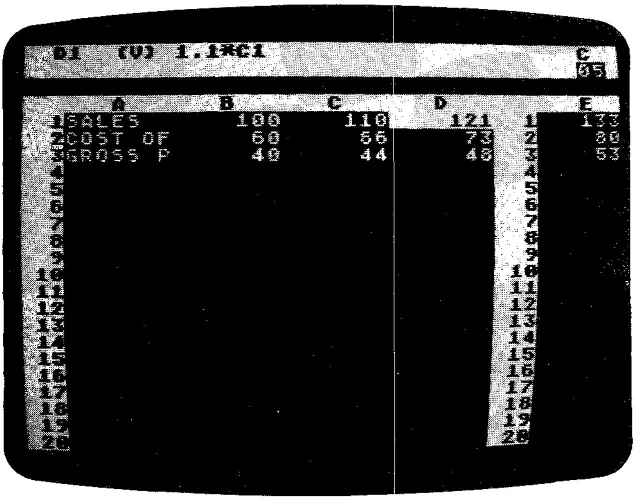
The ability to fix titles in place and adjust column widths gives us some compensation for the limited size of the screen. But, suppose we'd really like to keep the wider columns and the cursor at B1, the initial sales figure, and change it, while watching what happens to the final sales and gross profit at column M. If only we had two screens. . . .

Splitting the Screen

Type >**E1**® to move the cursor to column E. Now, type the WINDOW command **/W** The prompt line reads

```
WINDOW: H V 1 S U
```

Press **V** (for Vertical). Your screen should look like the photo below.



You have created two screen windows. Each one can be scrolled independently to view any portion of the electronic sheet. At present, the cursor is in the left hand window. Use the ↓ key to move the cursor downwards to row 21 and beyond. The left window will scroll downwards to follow the cursor, but the right window will remain still. Bring the left window back to the top of the sheet with >**B1**®

You may have noticed that the column widths that we set earlier have changed in the right window. VisiCalc must sometimes narrow these widths to accommodate the extra border that split windows add to the screen. Whether VisiCalc narrows columns or not depends on width requirements. See the WINDOW Command Reference for further details.

Press the semicolon **;** key to jump the cursor into the right hand window. Press the → key to scroll the right window across to column M. We now have both the beginning and ending months' sales, cost of goods and gross profit figures visible at the same time.

Press **;** again. The cursor jumps back to the left window. Each time you press the **;** key, the cursor jumps from one window to the other. Notice that the cursor has landed at the same position it was on when we last jumped out of the left hand window.

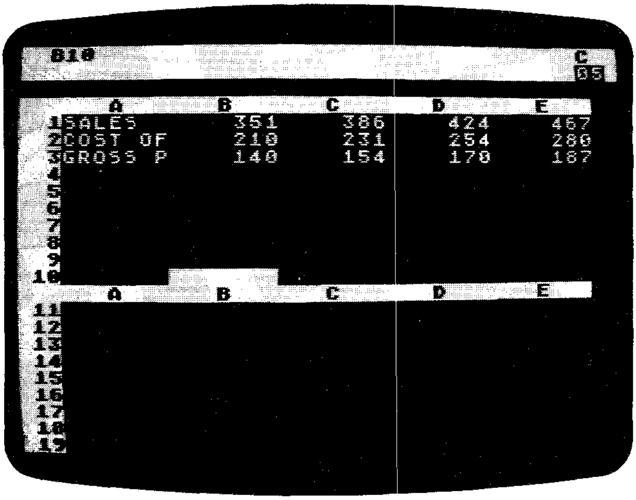
Now we can change the initial sales figure and watch what happens in the final month. Type **123**® and let VisiCalc recalculate. Notice that during recalculation an **!** appears in to the right of the "C" in the upper right corner of the screen.

SALES in column M should be 351. Try typing a few more numbers with the cursor at B1. See if you can find, by trial and error, the initial sales figure that

yields twelfth month sales of 1000 (rounded to the nearest integer). Hint: You can type a number with a decimal point, even though it will be displayed in rounded form.

When you finish experimenting with recalculation, type the WINDOW command **/W** and the numeral **1** for one window, the normal screen. We have seen that the idea of a split screen is useful. Can we get any more mileage out of this approach? Take a look at the screen, and notice how much of it is empty. Perhaps we can use the lower part of the screen to better advantage.

Type >**B11**® to move the cursor down to the middle row of the screen. Now type **/WH** (for horizontal). Your screen should look like the photo below.



This time the screen is split horizontally into a top and bottom window. Press the **;** key to move the cursor into the bottom window. Next hold down ↑ to scroll the bottom window upwards until the cursor bumps into the top edge of the sheet. Both windows are now displaying the same portion of the electronic sheet!

The cursor should be at B1 in the bottom window. Change the number at B1 to 100 in the bottom window, and watch what happens. The recalculation affects both windows. Use the → to scroll the bottom window to the right until column M comes into view. Now you can see the figures for the first and the last months at the same time.

Global Commands in Separate Windows

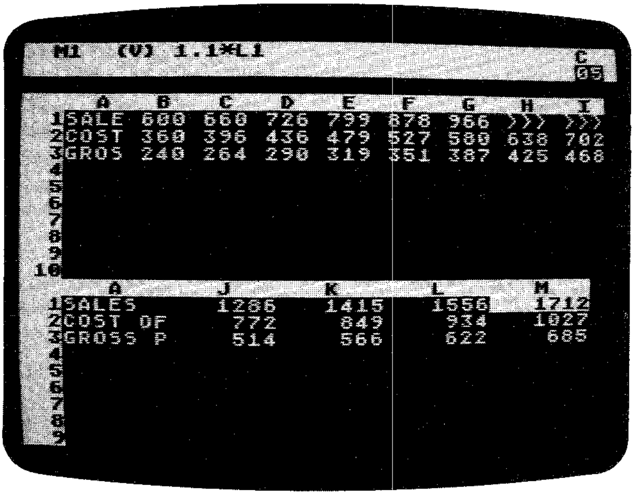
VisiCalc allows you to have different column widths in each window. To accomplish this, press **;** to move the cursor into the top window. Now, type **/GC4**® to change the upper window column width to four characters, while the lower window retains a width of seven characters.

Always remember that the global commands /GC and /GF affect *only* the window in which the cursor rests at the time the command is typed.

You've just done a global column change. Now let's try a global format change. Begin by pressing **;** to move the cursor to the bottom window. Type **/GF$** You now have dollars and cents displayed in the bottom window and integers in the upper.

Press **;** to jump the cursor into the top window and type >B1® to highlight our original sales figure. At B1, type the number **300** followed by ® and watch the changes ripple through all the columns as VisiCalc recalculates all the formulas. Now type the number **600®** What happens?

Columns H through M show > symbols in some positions instead of numbers. The calculated results are too large to display in integer form in the narrow columns of the top window, or with two decimal places in the bottom window. You can press **;** and type **/GFI** to see the final sales figure at M1 in the bottom window. It should be 1712.



Summary

You have covered a lot of ground in this lesson. We encourage you to review any points you might have had difficulty with and to try your own experiments. The more you work with VisiCalc, observing and analyzing the results, the more quickly you will master it for your own work. Just remember the following key points:

1. No matter what you type at the keyboard, you cannot hurt either the computer or the VisiCalc program. Moreover, it's fairly difficult to destroy your own work on the electronic sheet, particularly if you watch the prompt line for keystroke-by-keystroke feedback and save the sheet periodically on diskette.

2. Throughout this lesson, we have introduced only four new commands. They are:

The **REPLICATE** command **/R** that reproduces similar formulas in adjacent rows and columns.

The **GLOBAL** command **/G** that changes the columns width (**/GC**) and the way numbers are formatted (**/GF**).

The **TITLES** command **/T** that fixes rows or columns of alphabetic titles in place, as part of the top or left hand "border."

The **WINDOW** command **/W** that splits the screen, either horizontally or vertically, into two independently scrollable, formattable windows.

Much of the power of VisiCalc is due to the simple and highly consistent way in which these commands interact with one another. In almost any context, a command will do what you would logically expect.

3. Aside from the replicate command, which basically saves you time as you write formulas, all of the commands discussed in this lesson affect only the *appearance* of your work on the screen (generally in an effort to compensate for a small screen size). Nothing you might do with the /G, /T or /W commands can affect the labels, numbers or formulas actually written on the sheet. When in doubt, you can always type **/W1 /TN /GFG /GC9**® to return everything to normal.

Armed with these assurances, you should be ready to *experiment*. Clear the screen and try out these commands with a problem of your own. If you don't understand something, go back through this lesson to see what you might have missed. Also check Part III, the VisiCalc Command Reference section and the VisiCalc Reference Card for more complete explanations. Once you understand the fundamentals of this lesson, you'll know enough about VisiCalc to begin using it effectively.

Postscript: Memory and the Electronic Sheet

As you may know, your computer contains two kinds of fast semiconductor memory: RAM and ROM. ROM or "Read Only Memory" is manufactured with a fixed pattern of data or program instructions stored in it. RAM or "Random Access Memory" is made in such a way that it retains data that is put into it only as long as the memory's electric power is left on or until new data is put into the memory in place of the old data. Data or program instructions are put into RAM memory either by typing at the keyboard or by loading prerecorded programs or data from cassette or diskette.

The VisiCalc program is loaded into RAM memory from diskette, and it, together with some RAM that the computer itself requires, takes up about 26K bytes. The remainder of RAM memory is devoted to the VisiCalc electronic sheet. VisiCalc manages this area of memory automatically. You never have to concern yourself with the details of how the electronic sheet is maintained. But you will find it useful to have a general idea of how the sheet works as you begin using VisiCalc to its fullest capacity.

Essentially, VisiCalc reconfigures the electronic sheet *dynamically*. That is, VisiCalc expands the size and shape of the sheet as you use it. You actually start with a 1 by 1 sheet, starting and ending at position A1. Although you can

move the cursor to any position up to BK254, no memory is actually allocated for the sheet until you write something on it.

Then the sheet grows into a rectangle just large enough to include the rightmost and bottommost positions in which something is written. If you type a long message or formula at a particular entry position, VisiCalc will reserve additional bytes of memory for the position, but all of the other positions on the sheet will remain just large enough to hold the information which you have written in them. This is called "dynamic memory allocation."
VisiCalc continually displays the amount of memory available to you through the **memory indicator**. The memory indicator is the two-digit number located in the right corner of the prompt line just below the letter C. This number is the amount of memory in kilobytes still available for additional entries on the sheet. With 32K of memory, this number should be 06 (or close to it). The memory indicator will vary as you write information on the sheet or use commands such as replicate, to write information.

As you move further downwards and to the right, writing labels, numbers and formulas, more and more memory is used until the available memory is exhausted. If you finally exhaust all of the available memory, VisiCalc will flash the exclamation point in the upper right corner of the screen, replace the memory indicator with the letter M, and refuse to write anything more on the sheet.

To sum up, VisiCalc manages memory efficienctly and automatically. Because memory is dynamically allocated and the sheet is reconfigured to suit your needs, you can work ahead of yourself in terms of memory. Note, however, that if you have a relatively small amount of memory, you certainly shouldn't be wasteful with it. Aside from noticing from time to time how much space is still available for you to write in more entry positions, you need not concern yourself with problems of memory management.

Shrinking the Sheet

One thing VisiCalc does not do automatically, however, is to "shrink" the sheet. Suppose that you have written on various portions of the sheet, causing it to grow to a size of 100 by 100 positions. Later, having finished with this information, you might have erased or blanked out the entry positions near the right and bottom edges of the 100 by 100 sheet.

However, the sheet will remain configured as 100 by 100, although each empty position will require only 2 bytes. If you begin using additional memory by writing lengthy labels and formulas in other positions, you may want to shrink the sheet to the smallest possible configuration for the information still written on it.

To do this, you must save the sheet on diskette with the /SS command (as discussed in Lesson One), clear the sheet with **/CY** and reload the saved sheet with the /SL command (as discussed in Lesson Two). As the disk file is loaded, VisiCalc will enter on the sheet only those labels, numbers and formulas actually saved, and in the process the sheet will grow from a 1 by 1 configuration to just the size you need for the information remaining. This will make more memory space available for additional labels and formulas.

Lesson Three

Lesson Three

In Lessons One and Two, we used several examples to illustrate both the simplicity and the power inherent in VisiCalc's concepts and features. In Lesson Three we will expand on the use of previously learned commands, bringing them into more powerful combinations.

To present these new combinations and to introduce new commands, we will set up a household budget as our example. We will supplement this example with suggestions on how you can adapt it to your personal use. Continue to work carefully through the examples and experiment to deepen your understanding. You skill in using VisiCalc will grow proportionally with the amount of practice you have with it.

Let's begin with a clean slate. Load the VisiCalc program into your computer as described in the section entitled "Loading VisiCalc," or, if you already have the program running, clear the sheet by typing **/CY**

To prepare a budget, we'll first project our income for the next twelve months. We'll also project various necessary expenses such as food, rent or mortgage, telephone, etc. as well as semiannual expenses such as car insurance. Then we'll use VisiCalc to find out how much of our income is left for leisure and for savings and what percentage of our income is going for each category of expense. Finally we'll consider various enhancements such as calculating the interest on our savings account.

Setting up for the Budget Sheet

Let's begin by laying out twelve months or periods across the sheet. With the cursor at A1, type the word **PERIOD** to label row 1 and press the ▸ key to move on to position B1. At this point, we have three choices as to how to number the twelve periods.

First, you could just type in the numbers 1 through 12 from B1 through M1. Second, you could type in a few numbers and replicate the rest, using the cursor to point to the extra coordinate positions. Third, you could type in the beginning number (1) at B1 and replicate that number with a relative formula that would add 1 to each previous number.

For speed in setting up the sheet, let's use the third method. After all, we know from our earlier example that a label at A1 with twelve periods (months, years, etc.) following will extend to M1. If we weren't sure how many columns we would have to use, method two would be preferred.

With the cursor at B1, type in the number 1, our starting numeral and press the ▸ key. Let's put our initial "counting formula" at C1. A counting formula should add one to each previous number, right? So, type **1+B1®** at C1. The prompt line should read `C1 (V) 1+B1` and coordinate C1, highlighted by the cursor, displays the result of that formula as the number `2`.

Now, let's replicate this formula from D1 to M1. Type **/R®** The prompt line reads `REPLICATE: TARGET RANGE`. The edit line reads

`C1 . . . C1:`

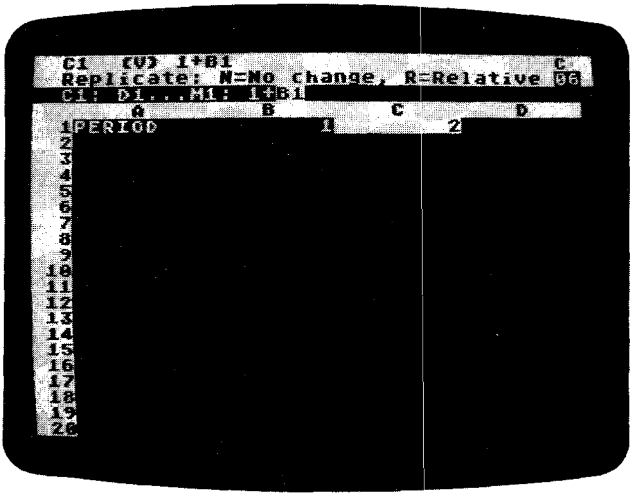
followed by the small rectangle. Type **D1.M1** (D1 is our starting position; the period is our coordinate delimiter; and M1 is the final coordinate). The edit line should read

C1 . . . C1: D1 . . . M1

Now press ® The prompt line reads REPLICATE: N=NO CHANGE, R=RELATIVE. The edit line reads

C1: D1 . . . M1: 1+B1

with a highlight on B1 as in the photo below.



Press **R** to make the coordinate relative: This will give us 1+C1, **1**+D1, etc. If you chose N, the absolute use of the formula would give you 1+B2—the numeral 2—in every position from D1 through M1. The prompt and edit lines should go blank. Move the cursor out to column M to check your work. Position M1 should show the number 12.

Replicating Numbers and Labels

To start filling in our budget sheet, type the following characters. End each entry with the ® key as shown:

>A2® INCOME➧1800®

We'll assume that $1800 is your monthly "take-home pay" after taxes and other deductions. Now let's fill in the figure 1800 for all twelve months. Press **/R®** Can you replicate a single number as well as a formula?

Of course: a number is actually the simplest case of a formula. For the target range, type **C2.M2** ® VisiCalc doesn't ask whether the new formula is relative or not, because the "formula," 1800, has no coordinates. The number 1800 should now appear in all twelve columns, in positions B2 through M2.

Next, we'll draw a line across the sheet. Move the cursor with >A3® and then type /— The prompt line reads LABEL: REPEATING, and a small rectangle appears on the edit line. Whatever character or characters we type next will be repeated to fill the entry position A3.

Type — followed by ® You should now have a line of nine hyphens at A3. Is this any different from typing the hyphens manually? Type **/GC12®** As you can see, the repeating label expands to fill the widened entry position. Go back to normal width by typing **/GC9®**

How can we easily extend the line across all twelve columns? The ever-useful replicate command will also replicate labels. Type **/R®** For the target range, type **B3.M3®** It's that simple. You should now have a line of hyphens extending all the way to column M.

Using Formulas For Flexibility

Before we go any further, let's think about what we've done. To save ourselves the trouble of typing the number 1800 twelve times, we replicated this number. That's fine as far as it goes, but is it the best way to handle our income? It would be better if we could change the income figure for all twelve months by just typing a new figure for the first month and taking advantage of VisiCalc's recalculation feature. Let's replicate a formula instead of a number. Type

>**C2®**
+**B2®**

We have defined the second month's income to be the same as the income for the first month. Next, let's replicate: Type **/R®** The target range is **D2.M2** ® Now the prompt line reads REPLICATE: N=NO CHANGE, R= RELATIVE. Do we want the same formula, +B2, in all of the remaining positions, or would we prefer +B2, +C2, +D2, etc.? Either way we can change the income for all twelve months simply by typing a new number at B2.

Think further. What if we should get a raise in the sixth month? If every formula read "+B2" (the NO CHANGE case) you could change any month besides period 1 by typing in the new income figure. However, VisiCalc wouldn't replicate this change to later months, because all figures are based on B2.

If, on the other hand, each formula refers to the previous month (the RELATIVE case), we can simply type a new number in month 6 and "propagate" the change through months 7–12. Let's try it. Type **R** to make the coordinate B2 relative. When the replicate command has finished, use the ▶ key to move to month 6 (position G2). Now type **2000®**

Press ▶ a few more times to verify that each succeeding month's income has changed to 2000. Were you able to foresee the way in which the change would be propagated? Note that G2 now contains a number (2000) instead of the formula +F2. H2 is +G2. Naturally, it will copy anything in G2.

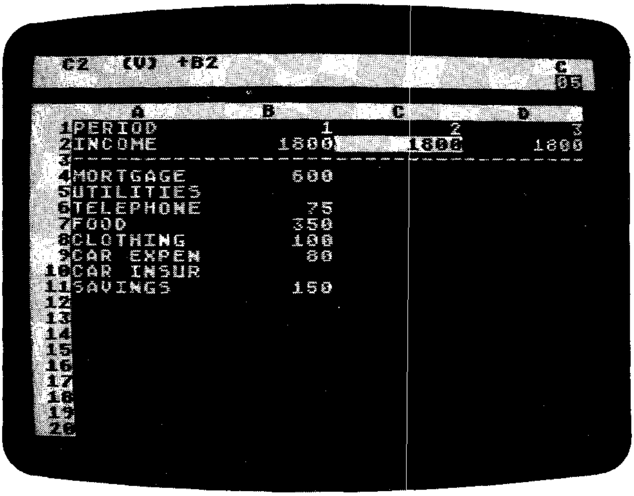
Likewise, I2 reads +H2, so what was in H2 (2000) will be replicated into I2, and so on through M2.

If you weren't sure, move the cursor over all twelve income figures and imagine what would have happened if all of the formulas were +B2. Or, if you feel adventurous, go back to where you began replicating this example (with the cursor on C2) and choose the NO CHANGE option to see what happens.

Our next task is to list our expense categories and estimate monthly amounts for each category. Some expenses will vary from month to month, and other expenses will occur perhaps only every six months. We will leave these blank for the moment. You can either type the following exactly as shown, or you can use the arrow keys to move the cursor and save yourself some keystrokes. Hint: to take full advantage of the arrow keys, type all the alphabetic labels first.

>**A4®**
MORTGAGE➧600➧
>**A5®**
UTILITIES➧
>**A6®**
TELEPHONE➧75➧
>**A7®**
FOOD➧350➧
>**A8®**
CLOTHING➧100➧
>**A9®**
CAR EXPENSE➧80➧
>**A10®**
CAR INSURANCE➧
>**A11®**
SAVINGS➧150➧
>**C2® ➧**

At this point your screen should look like the screen photo below:



Next, we would like to replicate the monthly expense figures in column B across for the remaining eleven months. Remember our discussion of the merits of replicating a number versus a formula for our monthly income?

To give ourselves maximum flexibility, we should also replicate relative formulas for the monthly expenses. At C4 we want the formula +B4; at C6 we

want the formula +B6; at C7 we want +B7; and so on. (We'll fill in figures for UTILITIES and CAR INSURANCE later.) These formulas are so similar to each other and to the income formula +B2 that it's tempting to look for a shortcut way of typing them. Once again, the replicate command comes to our aid. This time, we'll replicate a formula down a column instead of across a row.

Replicating Down a Column

Make sure that the cursor is at C2. The entry contents line reads C2 (V) +B2. Just as we copied B2 to C2, we will want to copy B4 to C4, B5 to C5, and so on. Therefore, we want to treat the coordinate B2 as *relative*. Type **/R**® The prompt line reads

```
REPLICATE: TARGET RANGE
```

with `C2 . . . C2:` on the edit line, followed by the small rectangle. Press the ➡ key twice to point to the first coordinate in the target range. Now the edit line reads

```
C2 . . . C2: C4
```

Type a period. The cursor jumps back to C2, and the edit line acknowledges that the target range will start at C4. Next, press the ➡ key nine times (or hold it down to utilize the auto repeat ability) to point to position C11 (opposite the figure for SAVINGS). The edit line now reads

```
C2 . . . C2: C4 . . . C11
```

This means that the formula at C2 will be replicated through the target range of C4 through C11. Press ® The cursor jumps back to C2, and the prompt line reads `REPLICATE: N=NO CHANGE, R=RELATIVE`. The edit line reads

```
C2: C4 . . . C11: +B2
```

with the highlight over the coordinate B2. We want this coordinate to be relative: Press **R** A column of numbers, from 600 to 150, appears in column C. Use the ➡ key to move the cursor downwards, pausing to look at the formulas we've replicated. We have what we wanted: at C4 is +B4, at C6 is +B6, and so on. We also have formulas at C5 and C10, but we can easily eliminate them. You can use either the ➡ or the ⬅ (depending on your present position) and **/B** to do this, or you can use the GO TO command as follows

>C5®
/B➧
>C10®
/B➧
>C4®

Replicating a Column Several Times

We now have the formulas we want for each expense category. The next step is to replicate these formulas across the rows through month 12. Think back to Lesson Two. Do you remember how we replicated a source range of formulas across the rows for both COST of goods sold_and GROSS profit? We can do the same thing here.

Press **/R** and the prompt line will read `REPLICATE: SOURCE RANGE OR RETURN`. The edit line shows C4 followed by the small rectangle. This time our SOURCE RANGE will be an actual range from C4 through C11. Now point to each coordinate in that range by pressing the ↓ key seven times to move the cursor down to C11. The edit line should read

`C4 . . . C11`

followed by the small rectangle. Now press ® The cursor jumps back to C4, and the prompt line asks for a `TARGET RANGE`. Type **D4.M4®** as your reply.

We have asked VisiCalc to replicate the formula at C4 into positions D4 through M4, the formula at C5 into positions D5 through M5, the formula at C6 into positions D6 through M6, and so on through the formula at C11. Notice that we gave only the first coordinate in each column in the target range.

The prompt line reads `REPLICATE: N=NO CHANGE, R=RELATIVE`. The edit line shows

`C4: D4 . . . M4: +B4`

with the small rectangle highlighting B4. This is the formula for the first expense, MORTGAGE. As was the case for B2 (INCOME), B4 should be relative. Press **R** and watch the screen. Several things happen:

1. The cursor disappears (don't worry);
2. The number 600 appears at position D4;
3. The edit line now reads `C6: D6 . . . M6: +B6`

VisiCalc has finished replicating the formulas +B4, +C4, +D4, etc. in row 4, and has also replicated the blank entry at B5 into C5, D5, E5, etc.

In replicating a source range, VisiCalc lets you consider each item in the range individually. Should each formula be interpreted as a NO CHANGE or RELATIVE formula? Therefore, VisiCalc asks you how to handle the formula +B6 on row 6.

All of these formulas will be relative too. Press **R** five more times. With relatively few keystrokes, you have written a total of 80 numbers and formulas on the electronic sheet, with the aid of the replicate command.

Think about the technique we used to replicate the expense formulas. Starting with the prototype formula +B2 at position C2, we created six more prototype formulas by replicating down a column: +B4 at C4, +B6 at C6, etc. Then, we used these formulas as our source range to replicate similar formulas across on rows 4 through 11.

Each of the resulting monthly expenses can be changed for all twelve months simply by typing a new number for the first month. For example, type **>B8®** and change the number there to **120®** Your CLOTHING budget is raised to $120 for all twelve months.

To complete our projection of expenses, we'll fill in figures for those expenses which cannot be replicated across because they vary from month to month. Our UTILITIES bill will vary depending on the season and the need for heating or air conditioning. Our CAR INSURANCE premiums are due every six months; we'll pay a premium in month 1 and month 7. Type the following exactly as shown

>**B5**®
140▶140▶80▶80▶40▶40▶85▶85▶50▶
50▶100▶140▶
>**B10**®
160▶
>**H10**®
160▶

We do not have to fill in zeros for the other ten months in the row for CAR INSURANCE, because VisiCalc treats any blank entry as equivalent to zero. (In fact, any entry containing an alphabetic label will have a "value" of zero if it is referenced elsewhere in a formula.)

Now is a good time to save your work on diskette, if you have not already done so. Make sure that your disk drive's BUSY light is off, then remove your VisiCalc program diskette and replace it in the pocket on the inside front cover of this manual. Now insert an initialized storage diskette into drive 1 with the label side up, and the oval cutout entering the drive first. Close the drive door, and type **/SS LSTHREE1** ®

The disk drive should whir for a few seconds, and, if all is well, the drive will quiet down, and the prompt and edit lines will go blank. You should also, at this time, make a backup copy of this file on another diskette which you do not use except for storing the backup files. If you should decide to end this session at this point, *be sure to remove any diskettes from the disk drive before you turn off the disk drive.*

Fixing Titles In Both Directions

Again, we have a situation in which we will lose our descriptive titles INCOME, MORTGAGE, etc., if we scroll the window horizontally to look at later months. To solve this problem, we'll create a border of titles along both the left and top edges of the sheet and fix them in place.

Move the cursor with >**A3**® and type the title command **/T** The prompt line reads

```
TITLES: H V B N
```

The meanings of the keystrokes H, V, B and N are described in Lesson Two and in Part III, The VisiCalc Command Reference. Press **B** to fix titles in *both* directions.

The position of the cursor has a dual significance for this command. If you type **/TV** to fix titles vertically, VisiCalc will fix in place the *column* in which the cursor rests and all columns currently on the screen to the left of the cursor. If you type **/TH** to fix titles horizontally, VisiCalc will fix in place the *row* in which the cursor rests, and all rows currently on the screen above the cursor. Typing **/TB** is equivalent to typing both /TV and /TH, so the exact position of the cursor is important.

In this case, we have created a border consisting of column A along the left edge of the screen window, and another border consisting of rows 1, 2 and 3 along the top edge of the window. To check this, hold down the ▼ key to scroll the window downwards past row 21. Rows 1, 2, and 3 remain in place. Now type >**B4**® and press the ▶ key to see how the window scrolls horizontally, leaving column A in place.

Since all other numbers are the same from column to column, only the PERIOD and INCOME figures in rows 1 and 2 will change. Continue pressing the → key until columns A, M, N, and O are in the window. We'll use columns N and O to obtain totals and percentages for our income and expenses.

The Built-in Function @SUM

Type the following

>N1®
TOTAL↓

The cursor should be at N2. How can we find our total income for twelve months? You could always type

+B2+C2+D2+E2+F2+G2+H2+I2+J2+K2+L2+M2

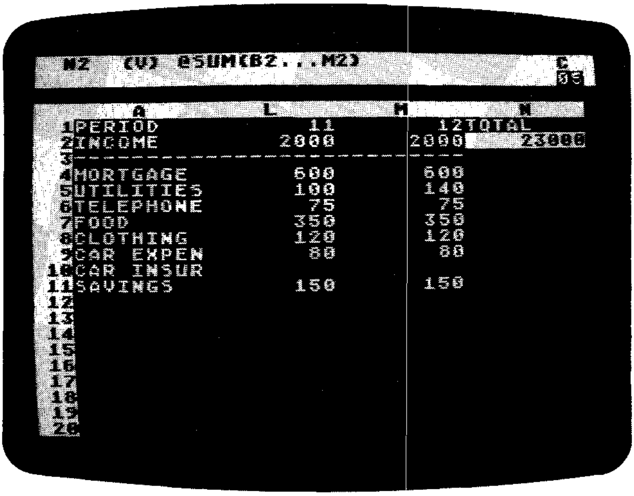
but there's a simpler way. Press @ watching the prompt line as you do so. As soon as you type the @ symbol, the prompt line says VALUE. Now type **SUM** and the edit line reads @SUM (followed by the small rectangle).

Now to indicate what numbers we want to sum. Hold down the ← until you begin "bumping into" the left hand border. The cursor should be at B2, and the edit line should read @SUM(B2 followed by the small rectangle.

Press **.** and the cursor jumps back to N2, where we started. The edit line now reads

@SUM(B2 . . .

As you can see, we are specifying a range of entries, just as we did with the replicate command. To finish this range, press ← **)** ® The entry contents line now reads N2 (V) @SUM(B2. . .M2), and under the cursor highlight is the number 23000, our total income for the year.



The @ symbol begins the name of a VisiCalc built-in function. When you began the entry at N2 with the symbol @, VisiCalc immediately knew that:

1. The entry was going to be a numeric VALUE;
2. The next few letters you typed would be the name of a built-in function.

Each built-in function, such as @SUM, performs some sort of calculation on the list of values given to it and yields a numeric result. Other examples of built-in functions are @MIN, @MAX and @AVERAGE. See the reference card and Part III, The VisiCalc Command Reference, for a complete description of all the functions.

Functions such as @SUM will operate over

1. A range such as @SUM(B2 . . . M2);
2. A list of particular values as @SUM(B2, B7, C3, D8);
3. A list of ranges, values, numbers or formulas, such as @SUM(B2 . . . B7, C3 . . . C6, 25, D8, 4*C8).

You can use any numeric result of a built-in functions just as you would an ordinary number. For example, you could place it in another function or formula. Let's get back to our example and obtain totals for each of the expense categories in our budget. We'll use replication again just as we did for INCOME.

With the cursor on N2 (our prototype formula), press **/R**® To enter the target range, type **N4.N11**® The prompt line displays `REPLICATE: N=NO CHANGE, R=RELATIVE`, while The edit line reads

`N2: N4 . . . N11: @SUM(B2`

with the small rectangle highlighting B2.

Consider what will happen if we make B2 . . . M2 relative. Since we are replicating down a column, the replicated formulas will be in positions N4, N5, N6, etc. We want N4 to be the sum of B4 . . . M4, N5 to be the sum of B5 . . . M5 and so on. That is what will happen if the replicated formulas are relative. Press **R** twice. In an instant, the expense totals, from 7200 to 1800, appear in column N.

Note that if you wish to insert new material into an @SUM range, the formula will expand to include the new numbers. In doing this, you must obey two rules. First, *never* place the insertion at the first item in the range. Second, *never* place the insertion at the @SUM formula. Both of these entry positions are out of range for the formula.

VisiCalc also lets you find out what percentage of your income each expense total takes. Type the following

>O1®
PERCENT↓↓↓

To find MORTGAGE as a percentage of INCOME you would divide your total mortgage payments by your total income, right? VisiCalc already has those totals—MORTGAGE at N4 and INCOME AT N2. Therefore, to find the percentage, all you need to do is divide N4 by N2. With VisiCalc, you don't have to use the dollar values, just the coordinates. Type **+N4/N2**® The result is .3130435, or approximately 31%.

Formatting a Single Entry

VisiCalc's general format always displays numbers to the maximum number of significant digits permitted by current column width, unless we ask for a different display format. For our purposes, two decimal places should be enough. The global format command /GF (from Lesson Two) allows you to display everything to two decimal places.

Type **/GF$** Our mortgage percentage at position O4 now appears as 0.31. Note, too, that all other numbers are also displayed in dollars and cents form. Even the month number 12 at M1 appears as 12.00. Not quite what we want. Change the global format back to "general" by typing **/GFG**

What we really want is to display just the number at O4, in dollars and cents form. With the cursor still at O4, type **/F$** That's it! By leaving out the global part of the command, we formatted just the single entry. /F$ affects only the entry highlighted by the cursor.

Now that the percentage 0.31 is set, look at the label TOTAL at the top of column N. It's hard to read because it's too close to the number 12 in column M, and it doesn't line up with the numbers below it.

Move the cursor to the label TOTAL with **>N1®** VisiCalc's *general* format for labels, which currently applies *globally* to all entries, including PERIOD, INCOME, etc.) starts alphabetic labels from the left side of an entry position and lines up numbers with their last digits on the rightmost positions of their respective columns. To change the format of TOTAL, type **/F** The prompt line reads

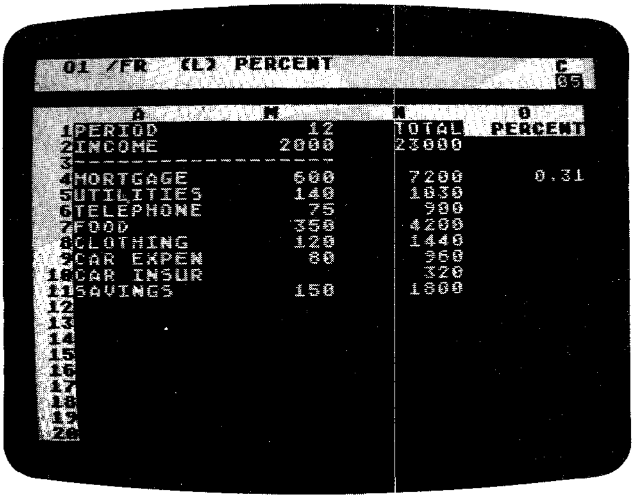
```
FORMAT: D G I L R $ *
```

The possible keystrokes are:

- **D** The format *defaults* to be the same as the global format. In other words, there is no special format for this entry.
- **G** Use the *general* format for this entry. You can use this, for example, to display a particular number with several decimal places even if the global format is I (integer).
- **I** Display this entry in *integer* format.
- **L** Start this number at the *left* side of the entry position.
- **R** Make the last letter or digit of the entry line up at the *right* end of the position.
- **$** Display this entry in *dollars and cents* format.
- ***** Display this entry in *graph* format.

For examples, see Part II, Lesson Four, Part III, The FORMAT Command and the reference card.

The TOTAL, type **R** Now TOTAL is lined up with the column of figures below it. Now press ▶ to move the cursor to O1, and press **/FR** to "right-justify" the label PERCENT.



Replicating a Format Specification

Now that you have a formula for describing an expense as a percentage of INCOME (+N4/N2), you can replicate it down column O rather than having to enter an individual formula for each expense category. Type >**O4**® to move to the formula for MORTGAGE expense as a percentage of INCOME.

Type /**R**® and enter **O5.O11**® as the target range. The edit line should read

`O4: O5 . . . O11: +N4`

with the +N4 highlighted. The prompt line reads `REPLICATE: N=NO CHANGE, R=RELATIVE`.

How should we handle the formula +N4/N2, which is MORTGAGE as a percentage of INCOME? For UTILITIES at O5, we want +N5/N2. The first coordinate changes, but the second, N2 or INCOME, does not. Press **R** to make N4 relative; then, with the highlight over N2 on the edit line, press **N** to indicate "no change." VisiCalc allows you to choose which parts of a replicated formula will be relative and which will be absolute.

It takes VisiCalc only a moment to display all our expense percentages, from 0.31 for MORTGAGE to 0.08 for SAVINGS. Notice that all of the percentages are displayed to two decimal places.

Press ↓ a few times, looking at the entry contents line. At O5, for instance, the line reads `O5 /F$ (V) +N5/N2`. The format specification /F$ has been replicated along with the formula. In fact, it's possible to replicate a format specification even if the entry being replicated is blank! We'll use this trick a little later.

Using Replicate To Copy a Row or Column

Type >**A12**® We'll draw a line under our list of expenses and calculate how much money we have left for LEISURE. You already know one relatively easy way to draw a line of hyphens, by using the /– command at A12 and replicating the hyphens across. But let's try using the replicate command a little differently.

Type **/R** The prompt line reads REPLICATE: SOURCE RANGE OR RETURN, and on the edit line is the cursor coordinate, A12, followed by the small rectangle. Now press **BACK S** The A12 disappears, leaving only the small rectangle on the edit line. Let's type a new source range: **A3.M3**® As usual, the prompt line reads REPLICATE: TARGET RANGE. Type **A12.A12**

What are we doing? The source range, A3 . . . M3, is the line of hyphens already written on the sheet. We're asking VisiCalc to replicate the entry at A3 into position A12, the entry at B3 into position B12, and so on. Press ® There's your line. Incidentally, it would have been sufficient to type **A12**® for the TARGET RANGE; VisiCalc would take this to mean A12 . . . A12.

Finally, let's add LEISURE to our budget. The money we have available for leisure will simply be our income minus the sum of our expenses. Type the following

>A13®
LEISURE➧+B2–@SUM(B4.B11)®

The figure for LEISURE, 125, appears at B13. Replicate this formula across row 13 to get your LEISURE money for each period: type **/R®C13.M13®** and press **R** three times to make the formula coordinates relative. Now start pressing the ➧ key to scroll the window rightwards, and examine the encouraging results VisiCalc has calculated for us.

Our LEISURE money starts small, at $125 in the first month, but it increases fairly steadily thereafter. After the first month, we don't have a car insurance premium, and our utilites bill goes down in months 3, 4 and 5. In month 6, we get our raise, which increases our INCOME and LEISURE money. Continue pressing ➧ until you have brought columns M, N and O into view, showing TOTAL and PERCENT, and then press ➧ to leave the cursor at N13.

To obtain a total and percentage of income for LEISURE, we can use the same method we used earlier to copy the line of hyphens. Press the following keys and watch what happens on the prompt and edit lines. Here we'll use : in place of ®

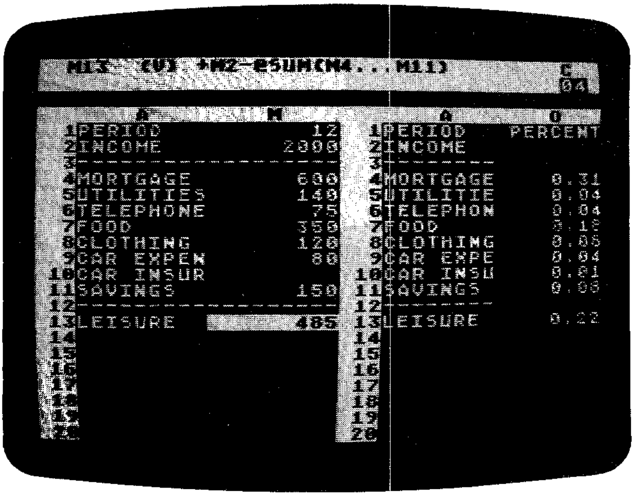
/R BACK S N11.O11:N13®RRRN

You should have a total of 5150 and a percentage of 0.22 for LEISURE.

Changing Windows and Titles

As we found in LessonTwo, the screen is too small to display both our starting expense figures in month 1 and our calculated totals and percentages in columns N and O. We can solve this problem by splitting the screen into two windows.

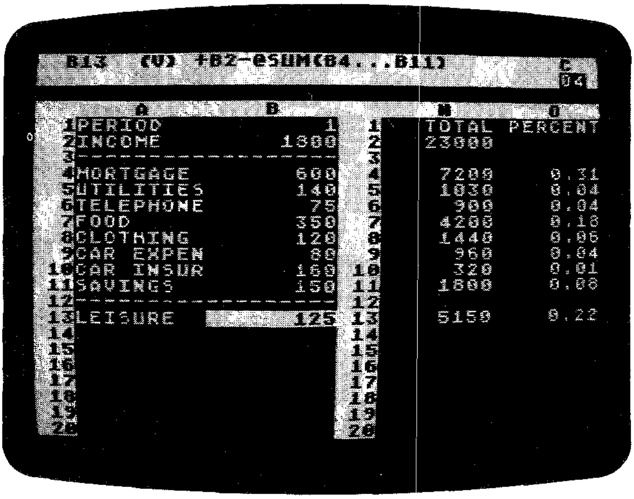
With the cursor still at N13, press **/WV** Your screen should look like the photo below. The titles in column A and rows 1–3 are fixed in place in both windows.



Press **;** to jump the cursor over to the right window, bringing columns A and N into view. Then press **/TN** to eliminate the fixed titles from the window in which the cursor rests. The title or "border" column A disappears, exposing column M. Finally, press → once to bring the TOTAL and PERCENT columns N and O into view.

Notice that columns are slightly narrower in this window. VisiCalc automatically adjusted the column widths to make room for the extra vertical border of row numbers that runs down the center of the screen.

Now press **;** to jump the cursor back to the left window. Press and hold down ← to scroll this window back to the first month (column B). Notice that you bump into column A. The fixed titles are still in effect in this window. Your screen should look like the screen photo below.



Let's try changing one of our expenses to see how VisiCalc recalculates the expense totals and income percentages. Type >**B9®100®** What happens? Your available LEISURE money decreases by $20 each month. The CAR EXPENSE total goes from $960, or 4% of your income, to $1200, or 5% of income. And your LEISURE total for the year goes from $5150, or 22% of income, to $4910 or 21%.

The @NA and @ERROR Functions

Press ↓ to move to position B10. Let's suppose that you were about to change your car insurance policy, and the new premium was not yet known. VisiCalc has a special function to help you deal with just such problems: the @NA function (@NA stands for "Not Available"). Watch the screen as you replace the number 160 at B10 by typing **@NA®**

When you write this function at an entry position, that entry takes on the special value NA. When VisiCalc recalculates, any formula which refers to an entry containing NA will itself have a value of NA. In this case, your car insurance premium for month 1 at B10 became Not Available. Because of this, you had no way to calculate your leisure money (income minus the sum of expenses) for month 1, and so position B13 (for LEISURE) became Not Available.

Moreover, your total car insurance expense for the year could not be calculated and also became NA, which meant that the corresponding percentage of income became NA. And, since one month's LEISURE expense was NA, the total was NA, and so was LEISURE as a percentage of income. Change B10 back by typing **160®** and all of the calculated values will be restored.

Here's a related issue: suppose that, instead of typing a number, you were trying to calculate your own car insurance premium as the insurance company does, but you made a mistake and tried to divide by zero.

With the cursor still at B10, type **1/0** ® As the screen shows, when VisiCalc evaluates the formula 1/0, the result is the special value ERROR. Like NA, the value ERROR "propagates." Any formula which refers to an entry with the value ERROR will itself have the value ERROR.

The most common ways to obtain a value of ERROR include dividing by zero, taking the logarithm of a negative number, and calculating a value too large for the computer to represent. ERROR can also be generated as a syntax error from an expression. For example, VisiCalc would reject a range attached to NPV as an invalid argument.

You can also deliberately obtain the value ERROR, just as you did for @NA, by typing the function name @ERROR. In fact, it can be used as a variant of @NA or as a debugging tool when working with lookup tables. For now, change the value at B10 back by typing **160** ® so that the totals and percentages can be calculated.

To make sure that we can continue from this point if something goes wrong, let's save the sheet on diskette again. The storage diskette that you used earlier in this lesson should still be in your disk drive. Type **/SS** and, in response to the prompt FILE FOR SAVING, press the ▶ key.

The disk drive should whir, and a file name should appear on the edit line. Continue pressing the ▶ key, if necessary, until you have the name LSTHREE1.VC on the edit line. Then press the **BACK S** key four times until the small rectangle is sitting where the 1 was. Now type **2**® and watch the edit line as you type the characters. You are saving the sheet under the revised name LSTHREE2.VC. Note: VisiCalc will automatically add the ".VC" for you. Once you've started, all it takes is a few keystrokes to protect yourself from loss of time and data.

Now, type **;** to jump the cursor into the right hand window and **/W1** This leaves the narrowed columns on the screen. When you type /W1 to return to one screen window, the global column, format, and title settings for the full screen are obtained from the window where the cursor lies at the time you type the /W1 command. If you had typed /W1 with the cursor in the left hand window, the screen would now have fixed titles and columns nine characters wide.

For now, type **/GC9**® and >**A7**® to adjust the column widths and scroll the screen back to the left edge of the sheet. The cursor should highlight the label FOOD.

The Insert and Delete Commands

Let's say you decide to take on a life insurance policy that has monthly premiums of $115, and you want to incorporate this expense into your budget. If you were working on an ordinary sheet of paper with the same arrangement of figures which we have on the screen, you'd have to erase something or write in tiny letters off to the side. But VisiCalc's electronic sheet is more flexible.

Type **/IR** for "insert row," and watch the screen. Everything at or below the cursor moves down to make room, leaving you with a blank line at row 7, where you can enter the life insurance figures.

Let's look more closely at what the Insert command had done, using SAVINGS as our example. The amounts for SAVINGS, which used to be on row 11, are

now on row 12. You might think that SAVINGS at B12 has, therefore, been moved beyond the range specified in the formula you wrote for LEISURE +B2−@SUM(B4 . . . B11)), which was income minus the sum of expenses.

Take another look at the LEISURE formula. Type >**B14**® and look at the entry contents line. VisiCalc has extended the formula to read +B2—@SUM(B4 . . . B12)! Whenever you insert (or delete, or move) a row or column, VisiCalc automatically adjusts all of the formulas on the sheet. This way, your formulas always refer to the same entry positions as before even though the coordinates have changed.

Now type the following to fill in the life insurance expense figures. We will begin by typing in the basic amount, making a formula based on it, and then replicating that formula across row 7. To conclude, we will create and replicate a life insurance formula for the TOTAL and PERCENT columns.

>**A7**®
LIFE INS▶115▶+◀®
/R®**D7.M7:R**
>**N6**®
/R▶:N7:RRRN
>**A10**®

Notice that our LEISURE money has decreased by the amount of the life insurance premiums each month. Position B14 is now −10, meaning that we're overspending our income in month 1. Perhaps we should ride the bus to work, and in that way all but eliminate our CAR EXPENSE.

Type >**B10** ® and then press **/D** The prompt line reads DELETE: R C. With the cursor at B10, you could delete row 10 by pressing R, or column B by pressing C. Press **R** to delete row 10.

The title and figures for CAR EXPENSE disappear completely from the screen. The rows below the cursor move up one row to and are renumbered to fill in the gap. CAR INSURANCE is now at row 10, and SAVINGS is back at row 11. Note that your LEISURE money at position B13 has increased, back to $90. If you were to check the formula at B13, you'd find that VisiCalc has readjusted it to +B2− @SUM(B4 . . . B11).

You can also insert columns. Say, for example, that you wanted to obtain six month totals for your income and expenses. Type >**H4**® The formula there is +G4 and because of relative replication the formula at I4 is +H4. Now press **/IC** A new, blank column appears in place of column H.

Notice that the insert command always inserts a row or column before the cursor's position ("before" meaning "closer to row 1 or column A than"). Press ▶ to bring the old column H (now relettered column I) into view. The formula at I4 is +G4, meaning that the propagation of the income and expense amounts skips over the newly created blank column.

Press ▶ twice more, and notice that the next formulas are +I4 and +J4. Now move back with >**H4**® and type **/DC** Now the blank column has been deleted, all of the other columns to the right have moved back to eliminate the empty space, and everything has returned to normal. If you've made any mistakes in this section, you can clear the screen, reload the diskette file named LSTHREE2.VC, and try each step again.

To test your understanding of the insert and replicate commands, try inserting the names of the months (such as JAN, FEB, MAR, etc.) just below the month numbers 1 through 12.

Have you succeeded? Here's one way to do it. Type exactly the following

>**A2®**
/IRMONTH→/FR/R:C2.M2: (*This replicates the format /FR.*)
JAN→FEB→MAR→APR→MAY→JUN→JUL→AUG→SEP→OCT→NOV→DEC→
>**A2®**

Calculating Interest On a Savings Account

According to our present budget, we are setting aside $150 each month for savings. Part of the motivation for doing this, of course, is that we would like to earn interest on this money. Let's use VisiCalc to project the interest and the accumulated balance we would have if we put this money into a savings or other investment account.

We'll assume that interest on a savings account is paid at the rate of 5% per year, compounded monthly. But, to give ourselves flexibility, we'll write this interest rate into a separate position on the sheet, so that we can change it later and let VisiCalc recalculate the interest and accumulated balance. Type

>**A15® SAV ACCT→.05®**

On the first day of each month, our account will be credited with interest for the balance in the account during the previous month, and then we'll deposit our monthly $150. Type the following

>**A17®**
/F$100→
>**A16®**
INTEREST→

The $100 at A17 is the previous balance in the savings account before our budget begins. The interest paid for one month will be one twelfth of the yearly rate (.05 divided by 12) times this previous balance. Type

/F$+B15/12*A17®

The calculated result of this formula should be 0.42, shown at B16. Does this figure make sense? A year's simple interest at 5% on $100 would be $5.00. One twelfth of this would be $5.00/12, or $0.41666 (which rounds to $0.42).

Press ↓ to move to B17. Our new savings account balance will be the previous month's balance, plus the interest, plus the savings deposit for this month. Type

/F$+A17+↑+B12®

(If you like, you can point with the cursor to fill in all three coordinates in this formula.) The result, as expected, is $250.42.

Now we can replicate both the interest and account balance formulas across for twelve months. Type

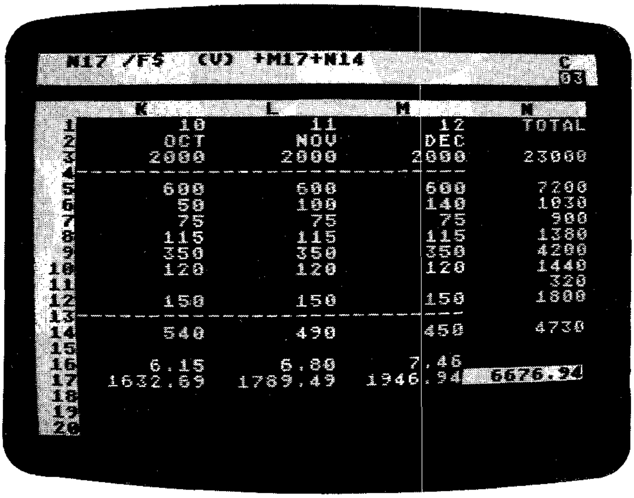
>**B16®**
/R↓:C16.M16:NRRRR

As you type the N and R's to determine whether each coordinate should be unchanged or relative, think about what each one means. The interest rate at B15 is clearly N. The R for A17 means "use the value of the entry one position down and to the left of each copy of the formula," and so on for the other coordinates.

Press ▶ to examine the calculated results. The interest paid each month increases, since both our monthly deposits and the accumulated interest are added into the balance on which the interest is based. Continue scrolling the window rightward until column N comes into view, and then type the following

>N17®
/F$+M17+N14®

This is the combined total of our savings and leisure money, or our "discretionary income." It should currently be 6676.94.



The Move Command

Type **>A11®** The cursor should highlight the label CAR INSURANCE. Paying that insurance premium in month 1 is taking a big bite out of our available LEISURE money in month 1 (which is $90, as opposed to $250 in month 2). Perhaps we can pay the insurance premiums by taking money out of the savings account.

On an ordinary sheet of paper, more erasures and writing in the margins would be necessary. Not so on VisiCalc's electronic sheet. Type **/M** The prompt line reads `MOVE: FROM. . .TO`, and on the edit line is `A11`, the cursor coordinate, followed by the small rectangle. Now press ▼. The cursor moves down to highlight SAVINGS, and the edit line reads `A11. . .A12`.

Press the ↓ key four more times, watching the edit line change from A11. . .A12 to A11. . .A16, much as it did for the @SUM function and the replicate command. The cursor highlights INTEREST at A16. Now press ® and watch the screen. The following things happen:

1. The entire row for CAR INSURANCE moves down from row 11 to row 15, reappearing just above INTEREST.
2. The rows for SAVINGS, LEISURE and SAV ACCT move up, taking up the space vacated by the old CAR INSURANCE row and making a new space just above INTEREST for the new CAR INSURANCE row.
3. The cursor returns to where it was when we started the /M command: at A11, which is now SAVINGS.

Now look at the figure for LEISURE in month 1. It has increased from 90 to 250. The car insurance premium has been taken out of the sum of expenses used to calculate LEISURE. The formula at B13 reads +B3—@SUM(B5 . . . B11).

Hence, the CAR INSURANCE expense is currently unaccounted for. We must revise the formulas in row 17 to take the car insurance premium out of the savings account balance. Type >**B17**® and look at the entry contents line. The formula reads +A17+B16+B11, meaning the previous account balance, plus a month's interest on that balance, plus this month's savings deposit. To this we must add "minus the car insurance premium (if any)." Type the following

+A17+B16+B11—↑↑®
/R:C17.M17:RRRR

This will replicate the new account balance formulas +A17+B16+B11−B15, +B17+C16+C11−C15, etc. across the row.

Now type >**N17**® to examine our total discretionary income. It has declined from 6676.94, before we took the insurance premiums out of savings, to 6666.10. We are now saving less and spending more on leisure. So, we have lost about $10 interest on our savings account. Notice that our LEISURE total at N14 has increased from 4730 to 5050. Perhaps we should save a little more each month to replenish the funds taken out to pay the insurance premiums.

Type >**B11**® to bring the titles back on the screen and highlight our initial SAVINGS figure at B11. Since the $160 expense for CAR INSURANCE at B15 covers our premiums for six months, we should save one sixth of this amount each month, in addition to our usual savings deposit. Type **150+(B15/6)**®

The parentheses in the formula tell VisiCalc to calculate that portion of the formula first. See the section entitled "The VALUE Command" in Part III for a full discussion of precedence. Thanks to our earlier use of formulas, VisiCalc automatically propagates the adjusted SAVINGS figure across all twelve months while recalculating LEISURE and our new savings account balance. This recalculation has made the screen display somewhat messy because the global format for numbers is still the standard format, or "general." We can clean up the display by typing **/GFI**

The interest and savings account figures still show dollars and cents, because each of these entries has the "local format" /F$. Now, type >**N17**® to reexamine our total discretionary income. It has increased to 6673.53.

By saving about $27 more each month, we have reduced our LEISURE total back to 4730, but we have regained most of the interest we had lost before. VisiCalc can really help you budget in ways that you wouldn't have contemplated before!

Before continuing, save your work by typing **/SS** and using → as necessary to bring the file name LSTHREE2.VC onto the edit line, and press **BACK S** four times, then type **3®**

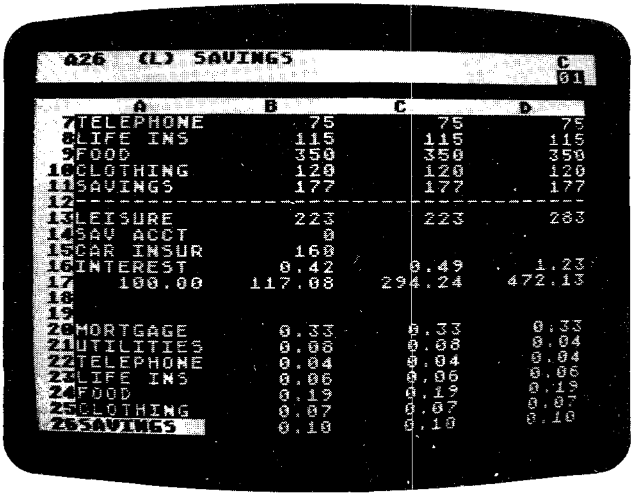
Obtaining Monthly Expense Percentages

This lesson has led you through some fairly sophisticated command combinations. Here's a little project you can try on your own—a challenge to test your mastery of the replicate command. Create monthly percentages for each of your expenses, from MORTGAGE through SAVINGS. It's possible to accomplish this by typing just one formula and using the replicate command twice.

Here are some hints. Use the area of the sheet directly below your list of monthly expenses. Remember that you can replicate format specifications. If you want to get fancy, you can label each row of percentages with one more use of the replicate command.

If you've succeeded, congratulations. You can probably do anything you want with VisiCalc from now on. Whether you've succeeded or not, let's make sure that your budget matches the one in this lesson. Clear the sheet by typing **/CY** Then reload the file you just saved with **/SL** Press → until the file name LSTHREE3.VC appears, and then press ® Now type exactly the following

>A20®
/R BACK S A5.A11:A20:
→/F$+B5/B3®
/R:B21.B26:RN
/R.B26:→.M20:RRRRRRRRRRRRRR (*Type R fourteen times.*)
>A26®



The first replication in this sequence illustrates another use of the replicate command. You can copy a range of entries into another part of the same column (or to any other area on the sheet) simply by specifying the destination starting coordinate for the target range. Check row 21, for UTILITIES, to verify that the percentages may change from month to month.

Synchronized Scrolling

As you can see, the area of the sheet that we have used extends beyond the screen window in both the horizontal and vertical directions. The window has begun scrolling downwards, and our month labels, INCOME, and our first few expenses have disappeared from view. Let's split the screen so that we can see both the expense amounts and the percentages at the same time.

Move the cursor up to A19, just above MORTGAGE. Now type **/WH** The screen splits horizontally, leaving just enough room for the expense percentages in the bottom window (which we'll attend to in a moment). Type >**A2®↓↓** This should leave rows 2 (MONTH) through 13 (LEISURE) on display in the top window, with the cursor at A4.

Next, type **/TB** to fix the horizontal and vertical borders in place. Notice that the columns and rows forming the borders do not have to start from the edges of the sheet. Finally, type **;** >**A26®** to bring all of the expense percentages into view and **/TV** to fix the labels MORTGAGE through SAVINGS in place.

Now press → until the bottom window begins scrolling rightward. The problem is that we can't easily tell which months these expense percentages refer to. The month labels, such as JAN, FEB and MAR, are visible only in the top window, which isn't scrolling.

We'd really like the two windows to scroll together horizontally, but remain independent vertically so that we can view different areas of the sheet through the two windows, as we are now (with rows 2–13 in the top window and rows 20–26 in the bottom). Press **/W** again, and look at the prompt line. The possible keystrokes are:

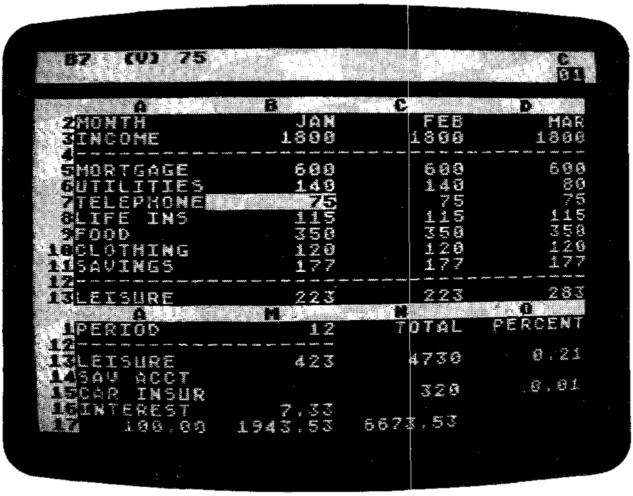
- **H** To split the screen horizontally.
- **V** To split the screen vertically.
- **1** To return to one screen window.
- **S** To synchronize the two windows.
- **U** To unsynchronize the windows.

Press **S** and watch what happens in the *top* window. Notice that this window scrolls over so that portions of the same columns are visible through the top and bottom windows. Now press → a few times: The two windows move together "in sync."

Type **;** to jump the cursor into the top window, and then type >**B7®** Try changing the TELEPHONE expense to something else, say $100 per month, and watch the line of percentages opposite TELEPHONE in the bottom window. Notice that LEISURE in the top window also changes.

Now, let's use the two windows for a different purpose. Type /**WU** to unsynchronize the windows. Move to the lower window with ; and type >**A1**®/**TB**>**O17**® to bring your LEISURE total and percentage, your final savings account balance, and your combined discretionary income into view.

Continue by pressing **;** to jump back to the top window, landing at B7. Finally, change the TELEPHONE expense back to 75, watching how this effects the LEISURE percentage in the bottom window. You can also experiment with the budget in other ways. At this point, you may wish to save the results of this lesson by typing, for example, /**SSMYBUDGET**®



The Order Of Recalculation

So far, we've simply noticed that VisiCalc recalculates the values of all the formulas on the sheet, but we haven't looked closely at how this is done. There are some subtleties to the process of recalculation that can affect your results when you set up a complex problem with many interdependencies. We'll consider these issues here.

VisiCalc recalculates by starting at the upper left hand corner of the sheet and working its way downward and to the right until it reaches the lower right hand corner of the sheet. Each formula is evaluated only **once**, unless you ask for an extra recalculation by pressing **!**

This means, for example, that the entry at position A1 cannot be a formula that references other positions, and that in general, formulas that reference other entries must be located below and/or to the right of these entries.

VisiCalc will evaluate the formulas on the sheet in either of two possible orders: "down the columns" or "across the rows." Look again at the letter C just to

the left of the direction indicator at the upper right corner of the screen. This is the **recalculation order indicator**, and it can be either C (for column recalculation) or R (for row recalculation).

When you load the VisiCalc program or clear the sheet, VisiCalc is set to recalculate "columns first:" It will evaluate first A1, then A2, A3, . . . , etc., then B1, B2, B3, . . . , etc., then C1, and so on. If you change the recalculation order to "rows first," VisiCalc will evaluate first A1, then B1, C1, . . . , etc., then A2, B2, C2, . . . , etc., then A3, and so on.

For many problems, the choice of row versus column first recalculation has no effect on the results displayed on the screen. But there are cases where you must use the right recalculation order to obtain correct results, and it's important to recognize these cases when they arise. Consider an example. Clear the sheet with **/CY** and type the following

```
1➧-A2®
>A2®
1+A1➧2*B1®
>C5®
+A1➧1+C5®
>C6®
-D5➧2*C6®
>A1®
```

As you type the formulas, think about how each entry depends on the other entries. As you can probably see, the matrix of entries starting at A1 must be recalculated in the order A1, A2, B1, B2 (since B1 depends on A2). The matrix of entries at C5, however, must be recalculated in the order C5, D5, C6, D6 (since C6 depends on D5).

With the cursor at A1, type **2** ® and watch what happens. A2 becomes 3, B1 becomes −3, and B2 becomes −6, as expected; but while C5 becomes 2 and D5 becomes 3, C6 remains at −2, and D6 at −4. The formula at D5 *was* recalculated, but this occurred *too late* to affect the recalculation of C6 and D6. Now press **!** to trigger an extra recalculation. This time C6 becomes −3 and D6 becomes −6.

Now we'll change the order of recalculation from "columns first" to "rows first." Press **/G** The prompt line agains reads `GLOBAL: C O R F`. Press **O** Now the prompt lines reads `REEVAL ORDER: R C`.

Press **R** Notice that the recalculation order indicator at the upper right corner of the screen changes from C to R. Now type **1**® and watch the screen. This time, D5 becomes 2, C6 becomes −2, and D6 becomes −4; but while A2 becomes 2, B1 stays at −3, and B2 at −6. Our problem with B1 and B2 is similar to our earlier problem to C6 and D6.

The moral of this example is that you should lay out your calculations with recalculation either by column or row in mind, but not both. If possible, you should arrange things so that the results will be correct with *either* type of recalculation. Then, if you decide to calculate something new that requires a particular order of recalculation, you won't be constrained by other dependencies on the recalculation order.

For example, the personal budget outlined in Lesson Three is independent of the order of recalculation. Now, suppose that you want to adjust your life

insurance policy and premiums to provide a benefit of three times your total annual income. You could do this by switching to "row first" recalculation, so that the life insurance premium in month 1 could be based on the total income calculated in column N.

If you find yourself with a problem of conflicting requirements for "row first" and "column first" recalculation, you can deal with these requirements, albeit awkwardly, by pressing ! for an extra recalculation each time you change a value and look for recalculated results. But first make certain that your row and column conflict is not actually due to a "forward reference" or a "circular reference," as discussed below.

Forward and Circular References

Clear the sheet with **/CY** and type **1➧—➧®** The entry contents line reads B1 (V) —C1, and the value displayed at B1 is 0, as expected.

Now type **➧1+➧➧®** The entry contents line reads C1 (V) 1+A1, and the value at C1 is 2, while the value at B1 has been updated to −2.

Next press >**B2®—C1®** We now have the same formula, −C1, at both B1 and B2, and both positions display the value −2.

Is there any difference between these two formulas? Indeed there is. One of these formulas will recalculate and display the correct value only if the order of recalculation is "row first." The other will never display the correct value after an automatic recalculation.

To see this, type >**A1®2®** and watch the screen. A1 becomes 2 and C1 becomes 3, but both B1 and B2 remain at −2. Press4 ! and both B1 and B2 will be updated to −3.

Now, type **/GOR** and note that the recalculation order indicator changes from C to R. Then type **3** ® and watch the screen. A1 becomes 3, C1 becomes 4, and now B2 becomes −4, but B1 remains at −3. You'll have to press ! again before B1 will change to −4.

If you change A1 again, B1 will display a value based on the previous contents of C1 and A1. The formula at B1 is an example of a **forward reference**. It contains a reference to an entry that will be recalculated after B1 is recalculated, regardless of whether you use row or column recalculation.

In extremely difficult cases, forward references may refer to other forward references, so that correct results can be obtained only with several recalculations. If the cursor is not on A1, type >**A1** Now try this example. Press **➧/IC—➧®**

At the moment, A1 is 3, the new B1 is 4, C1 is −4, and D1 is 4. Now press **➧ 1** ® A1 becomes 1, D1 becomes 2, but B1 and C1 are unchanged. Press ! Now C1 is −2, but B1 is still 4. Only after you press ! again will B1 be updated to 2.

An effect even more startling is caused by a **circular reference**. The value of such a formula cannot be settled with any number of recalculations! Clear the sheet with **/CY** and type **1+➧** ® The entry contents line reads A1 (V) 1+B1, and the value under the cursor is **1**, as expected.

Now type ▶1+◀® and watch carefuly. What happened? The numbers at A1 and B1 actually changed *twice*. When the formula 1+A1 was completed at B1, it was evaluated, yielding 1+1 or 2 at B1. Then, since the value of B1 had been changed, an automatic recalculation occurred. A1, or 1+B1, became 1+2 or 3, and B1, or 1+A1, became 1+3 or 4.

Now press ! A1 increases to 5, and B1 becomes 6. These values will change every time you press !

The foregoing examples have been somewhat artificial. You probably recognized the forward and circular references as soon as you typed them. If you are planning your work carefully, you shouldn't write such a formula, unless you do it purposely as a debugging tool. Some forward or circular references are not so obvious.

For example, suppose that you are projecting future profits, taking into account various revenues and expenses. One of the expenses is employee salaries, and one part of salaries consists of profit-sharing. Unless you are careful, you may create a circular reference. Salaries with profit-sharing depend on profits, but profits depend on expenses including salaries. To resolve this circularity, you must calculate a figure for profits before profit-sharing is taken out.

Once you are aware of the issues involved in recalculation, it is not difficult to avoid conflicts in the order of recalculation or forward and circular references. Generally, these problems arise when you are working too quickly without a plan, or "patching" an existing layout on the electronic sheet. If your approach to the problem is orderly and well thought out, it is unlikely that you will encounter any problems with recalculation.

Summary

Once again, we have covered a great deal of ground in this lesson. We concentrated on a variety of techniques for using VisiCalc's flexible replicate command as effectively as possible. We also discussed a number of new VisiCalc features, including the formatting of individual numbers and labels, and the relationship between global and local formats; the order in which VisiCalc calculates and recalculates; built-in functions such as @SUM, and the special cases @NA and @ERROR; the insert, delete, and move commands, which let you "stretch" the sheet and manipulate entire rows or columns; and synchronized scrolling of the two screen windows.

We have covered most of the important concepts and features of VisiCalc, and you should be able to use VisiCalc to considerable advantage. In Lesson Four we will cover a number of other features and fine points of VisiCalc, including scientific notation for numbers as well as the transcendental functions such as @EXP, @LN, @SIN, and @COS. You will also learn more about the formatting of numbers and the move command.

With the amount you have learned about VisiCalc, this is an excellent time to test your understanding on a problem of your own. In this way, you will consolidate your knowledge of VisiCalc's commands and features, and develop your own ideas about how they can be used. This will enable you to approach new problems and solve them even more rapidly with VisiCalc.

Postscript: The Print Command

Sometimes it's convenient to have a "hard copy" of the contents of the electronic sheet on a real sheet of paper. VisiCalc's print command lets you print all or any part of the electronic sheet on a printer. If you have a printer connected to your computer, you can try it out by printing a copy of the personal budget we've just created.

The instructions for printing files you have made with VisiCalc are in Part III of this manual, in the section entitled "The PRINT Command." Note as well that using a /SS to a printer is a good debugging tool, particularly in uncovering circular references.

Lesson Four

Lesson Four

Lessons One, Two and Three have covered most of the essential features of VisiCalc. In this lesson, we'll concern ourselves primarily with features which extend VisiCalc's usefulness in applications where complex or lengthy formulas, numbers with very large or small magnitudes, or sophisticated arithmetic operations are required.

If you intend to use VisiCalc for business or financial applications, you can skim much of this material, concentrating on topics of interest such as the @NPV (Net Present Value) and @LOOKUP functions and the ability to create bar graphs using the /F* formatting option. If you have scientific or engineering applications in mind, you'll find this lesson particularly relevant to your needs.

More On Numbers and Formats

In Lessons Two and Three we illustrated some of the ways you can control the display of numbers on the screen with formatting commands such as /GFI and /F$. In this lesson we'll examine the formatting options more closely.

Load the VisiCalc program into your computer (as described in Part I in the section entitled "Loading VisiCalc") or, if you already have the program running, clear the sheet with **/CY** When you clear the sheet, the "global format" is set to *general*. This is the effect you obtain when you type the command **/GFG** Each individual entry is set to *default* to the global format, just as it would if you had typed **/FD** with the cursor at that entry. Now type the following

123.456®
/R:▶.▶▶:

We now have the same number, 123.456, on display in three entry positions, A1, B1 and C1. Since we have not yet set any explicit formats, all three entries default to the global format. The *general* global format displays numbers in whatever form will show the value of the entry with the greatest precision. As you have seen, however, this may not be the most readable way to display a column of numbers.

Now press the following keys **/FI▶/F$◀** We have set the "local format" of A1 to *integer* and B1 to *dollars and cents*. The entry contents line displays the local format setting for the coordinate where the cursor lies, A1. It reads `A1 /FI (V) 123.456`.

VisiCalc displays the locally formatted entries in rounded form. At A1, for example, 123.456 is rounded down to 123, because .456 is less than .5. At B1, however, 123.456 is rounded up to 123.46, since the last digit .006 is greater than .005. At C1 the general format is still in force, so we still have 123.456.

Now type **/GFI** to change the global format from *general* to *integer*. Entries A1 and B1 are unaffected, because they have explicit local formats; but C1 now displays 123. With the cursor still at A1, change the local format there by typing **/FG** The number at A1 now appears as 123.456, and the entry contents line reads `A1 /FG (V) 123.456`. The local format overrides the global format integer.

Next, press ▶ to move to B1, and "erase" the local format there by typing **/FD** This causes the display format of B1 to default to the global format, which

is currently *integer*. The entry at B1 now appears as 123. The entry contents line reads `B1 (V) 123.456`. The explicit format setting /F$ has disappeared.

Finally, type **/GFG** to set the global format back to general. Now all three entries display the number 123.456. Position A1 has a local format which overrides the global setting, but the local format is also general. Positions B1 and C1 have no explicit format, so they default to the general format.

The way in which numbers are displayed in the general format depends on the column width. Type **/GC7®** Now the number appears as 123.46 at all three entry positions. VisiCalc always allows for one blank at the left end of the entry position, and then displays as many significant digits as it can.

To compare the flexibility of the general format to an explicit local format, try the following: If necessary, go to position B1 by typing >**B1** Type **/F$** to set dollars and cents format at position B1. Then type **/GC6®**

Positions A1 and C1 now display the number as 123.5, but B1 now shows >>>>>> (an effect that we saw before in Lesson Two). VisiCalc is telling us that it cannot display a number as large as 123.456 with two decimal places in a column six characters wide. If you type **12.34®** VisiCalc will be able to display this number at B1.

Scientific Notation

Type **/CY** to clear the sheet. At position A1, type eight nines (**99999999**) followed by ▶ This is the largest number that we can display, with a leading blank, in a nine-character column. Enter **1+◀®** followed by ▶

The calculated result, 1+99999999 or 100000000, is too large to display in ordinary form at B1, so VisiCalc has switched to **scientific notation**. The number appears as 1E8, meaning "1 times 10 to the 8th power" or "1 followed by 8 zeros." The "E" stands for "exponent," because the hidden 10 takes a displayed exponent (in this case, 8). Scientific notation (also referred to as "exponential notation") can also be used to display very small numbers.

At C1, type **.000000001** (that's 8 zeroes) followed by ▶ The number appears as 1.E−9, meaning "1 times 10 to the −9th power," or "1 with the decimal point moved left 9 places." Count the decimal point over nine places to the right and you'll see that this is correct. Now at D1 type **−◀®** The result is displayed as −1.E−9. In ordinary notation, this would read −.000000001 (as you will see in a moment).

When a number is displayed in the general format, VisiCalc will automatically shift between conventional and scientific notation as required to display the calculated value with the greatest precision. Type **/GC12®** Notice that all of the values revert to conventional notation in the widened columns. At D1, for example, the number appears as −.000000001.

Next, type **/GC7®** and >**A1®** The number 99999999 at A1 has been rounded up and displayed as 10.0E7, or "9.9999999 (rounded to 10.0) times 10 to the 7th power." Finally, type **/GC5®** and look at the screen. In order to fit the numbers in these narrow columns, VisiCalc has eliminated decimal points, displaying A1 as 10E7 and C1 as 1E−9; but D1 shows >>>>> since there's not enough room in a five-character column to display −1E−9 (with a leading blank).

More On Value References

Clear the sheet with **/CY** and type the following **1➧2➧+A1/B1®**

The entry contents line reads `C1 (V) +A1/B1`, and the value displayed is .5. We know that if the number at either A1 or B1 were changed, the formula at C1 would be recalculated. Now press ➧ to move to D1. Here we'll try something different.

Type **+A1/B1**# watching the edit line as you do so. As soon as you press the # after the coordinate B1, the reference to B1 is replaced by its current value of 2. The edit line now reads `+A1/2`. Press ® The entry contents line reads `D1 (V) +A1/2`, and the value displayed is again .5.

The difference is that the current value of B1 is "fixed" into the formula at D1, whereas the value of B1 is changeable at C1. To verify this, type **⬅⬅4®** and notice that C1 changes to .25, but D1 does not.

The effect of # after a value reference on the edit line is similar to the effect of typing **!** after a formula, as described in Lesson One. The difference is that the **!** key evaluates the entire formula on the edit line, replacing it with a single number, while the # key fixes the value of a single coordinate, so that the rest of the formula can contain changeable elements.

If the # is not preceded by a coordinate such as B1, it is replaced by the current value of the entry where the cursor lies, i.e., the entry you are changing. You can use this feature to take a look at the precise value of a formatted entry on the edit line.

For example, set the global format with **/GF$** and then type **6®** The value at C1 is now displayed as .17. Press ➧ to move to C1, then press # The # is immediately replaced on the edit line with the current value of C1 (1/6) to maximum precision.

A word on precision is in order here. VisiCalc maintains numbers internally in decimal form. Certain fractions (such as 1/6) cannot be expressed exactly with any fixed number of significant digits. VisiCalc uses decimal-based arithmetic for accuracy in calculations involving dollars and cents.

To accommodate large financial figures and high-precision engineering or scientific values, VisiCalc guarantees precision to eleven digits (and sometimes twelve digits) at base 10. The twelfth digit (the last 6 in the expression above) on the edit line at the moment is a "guard digit," which allows VisiCalc to determine which way to round the eleventh digit when a calculation is completed. After examining the number, you can press the **BREAK** key to cancel the VALUE entry you have started on the edit line.

More On Formulas

In the examples from previous lessons, we have used only simple formulas (or *expressions*) whose meanings have been clear. As you begin to write more complex expressions involving several arithmetic operations, the way in which such expressions should be evaluated may not be so obvious. For example, to evaluate the expression 9+6/3, should we first add 9 to 6 giving 15 and then divide by 3 to obtain 5; or should we first divide 6 by 3 giving 2, and then add 9 to obtain 11?

Try it. First clear the screen with **/CY** and then type **9+6/3**® The answer displayed at position A1 is 5. Evidently VisiCalc chose the first option. In this way, VisiCalc is similar to many keystroke calculators in that it always evaluates expressions strictly **from left to right**.

You can change the order of evaluation of arithmetic operations in an expression by using parentheses. Press ↓ to move to A2 and then type **9+(6/3)**® The answer at A2 is 11. Parentheses may be nested (placed within other sets of parentheses) any number of times.

Type in ↓ **–(**↑↑**+((A2–1)/A1))**® The answer displayed at A3 should be –7.

More generally, an expression consists of a series of *operands* separated by arithmetic *operators*. Each operand can be one of the following:

1. A number, optionally with a decimal point and/or an E exponent.
2. A value reference, obtained either with cursor movements or by typing the coordinate.
3. A function reference, with zero or more arguments in parentheses. An argument is any number that a function depends on for its value.
4. An expression surrounded by parentheses. (Such a subexpression is evaluated first.)
5. Any of the above, preceded by a – or + sign.

Each operator can be one of the following:

- \+ For addition.
- – For subtraction.
- * For multiplication.
- / For division.
- ^ For exponentiation.

The caret character (^) is the exponentiation operator. The caret is located on the asterisk * key with the ↑. To use it, you must hold down the **SHIFT** key and type the asterisk key. The exponentiation operator ^ lets you calculate "powers."

For example, type ↓**2^3**® to calculate "2 to the 3rd power," or 8.000000. Try another example. Type ↓**2^.5**® to calculate "2 to the power 1/2," or the square root of 2. The result displayed at A5 should be 1.414214. To find the cube root of 5, type ↓**5^(1/3)**® VisiCalc will calculate and display the value 1.709976.

More On Built-in Functions

We first encountered built-in functions in Lesson Three, where we used the @SUM function to find yearly totals for our income and expenses and to calculate our available LEISURE money as +B2–@SUM(B4.B11), or income minus the sum of expenses. As mentioned above, a function reference can appear in an expression wherever a number or coordinate could appear.

Moreover, as we shall see shortly, an expression may also occur as an argument in a function reference. We also saw that one type of function argument is a range of entries, such as B4 . . . B11 in the LEISURE example. You need type only one period; VisiCalc will fill in the other two. And you will see shortly that VisiCalc will "spell out" the names of built-in functions if you type just the first few letters and a left parenthesis.

In general, a built-in function name is followed by a parenthesized *list* of *arguments* separated by commas. Each argument can be:

1. An *expression*, i.e., a series of numbers, value references, and/or function references separated by arithmetic operators and/or parentheses; or
2. A *range* of entries, i.e., a series of entries that are next to each other in a row or column, such as B2, B3 and B4, or B2, C2, D2 and E2. A range is specified by typing (or obtaining with cursor movements) the first and last entry separated by an ellipsis (3 dots in a row). For example, the ranges just mentioned would be specified as B2 . . . B4 and B2 . . . E2, respectively.

The exact number and type of argument(s) required varies from function to function. For example, the @NA and @ERROR functions which we saw in Lesson Three required no arguments. Some functions require exactly one or two arguments, while others, such as @SUM, take a variable number of arguments.

Let's try an example of the @SUM function using the general form for a list of arguments. Notice that as soon as you type the left parenthesis, VisiCalc finishes spelling out the function name on the edit line. Use the ▼ key to move to position A7, and type

@S(A1.A4,A5*A5,A6^3)®

The result should be 5+11−7+8+2+5 or 24.00000. Let's experiment further with some other built-in functions.

The **@MIN** and **@MAX** functions accept a list of arguments just like the @SUM function. The result is the minimum and maximum value in the list, respectively.

Remember that the minimum value will be the negative number (if any) with the greatest absolute magnitude. That is to say, −4 is a smaller number than −3. If you removed their minus signs, 4 would be the number of greatest absolute magnitude.

Let's try out these functions. Watch what happens when you type in @**M** followed by a **(** VisiCalc adds **IN**. Similar "spell outs" occur with @**MA** and @**S**. Now go ahead and enter the following

▼@M(A1.A7)®
▼@MA(A7,@S(A1,A2,A4.A6))®

The results should be −7 for @MIN at A8, and 27.12419 for @MAX at A9.

The **@COUNT** and **@AVERAGE** functions also accept a list of arguments, which may be expressions or entry ranges. @COUNT determines the number of nonblank entries occurring in the range or ranges of the argument(s). Note that arguments that are expressions rather than ranges always count as 1. This can be puzzling if the "expression" is a single coordinate such as B1. It will add 1 to the count *even if B1 is blank*. To avoid this, write B1 . . . B1.

@AVERAGE finds the arithmetic mean of the entries making up the argument(s); it is equivalent to @SUM(*arguments*)/@COUNT(*arguments*). To try out these functions, clear the sheet with /**CY** and type the following

1▼▼3▼4▼▼6▼▼8▼/−−▼

The cursor should now be at A10.

Type **@C(A1.A8)®** The count of nonblank entries displayed at A10 should be 5.

Now type **↓@A(A1.A8)®** The average of 1, 3, 4, 6, and 8 should be 4.4 at A11.

To check the equivalence mentioned above, type **↓@S(A1.A8)/A10®** The result should again be 4.4.

Finally, let's change one of the currently blank entries in the argument range to a number. Type >**A5®5®** The @COUNT at A10 should change to 6, and the @AVERAGE at A11 and A12 should increase to 4.5.

The **@NPV (Net Present Value) Function** accepts two arguments. The first is a single expression specifying a discount rate, such as 15% per period (entered as .15). The second argument is a range of entries. The first entry is the cash flow at the end of the first period. The second entry of which is the cash flow at the end of the second period and so on for all the periods under consideration.

The result of the function is the net present value of the cash flows in the range, discounted at the rate specified by the first argument. If we represent the function reference (using dr to symbolize discount rate and n as the last number in a series of entries) by @NPV(dr,entry1 . . . entry*n*) and let DR=1+dr, the result of the function is

(entry1/DR) + (entry2/(DR^2)) + (entry3/(DR^3)) + . . . + (entryN/(DR^N)).

To see this function in action, begin by clearing the sheet and making narrower columns with **/CY/GC6®** Suppose that we have a project that requires an initial investment or cash expenditure of $5000, which is expected to generate cash over a period of five years. Type the following to lay out the cash flows

→1→1+←®
/R:D1.F1:R
>**A2®**
−5000→1000→1500→2500→2000→1000®
>**A3®**
.15↓

At position A4, type **+A2+@NPV(A3,B2.F2)®** This causes the $1000 cash flow in the first year to be discounted by 15%, the $1500 cash flow in the second year to be discounted twice, etc. The result at A4 should be 288.3.

Now press **↑** and change the discount rate to 10% by typing **.1®** The net present value at the lower discount rate (which makes the future cash flows worth more today) is 1014.

You can find the internal rate of return of this project by trial and error. Try higher and lower discount rates at A3 until the net present value of the cash flows is near zero. When A3 is .17, A4 will be 34.81. If you are persistent, you can verify that the net present value is .0000005 when the discount rate is .1728674256.

The @LOOKUP Function accepts two arguments. The first or "search" argument, an expression, is looked up in the table specified by the second argument, which is an entry range. The search argument is then matched against one of the entries in this range. Note: a table of function result values must be present in the column or row immediately to the right of or below the column or row range specified in the @LOOKUP function.

The function result is taken from the entry corresponding to the matched entry in the table of result values. The values in the function argument range are ordinarily in ascending order. The search argument is compared against succeeding entries in the second argument range until an entry greater than the search argument is found. The search argument is then "matched" against the entry just before this one, *i.e.*, one which is still less than or equal to the search argument. Finally, the function result is selected from the corresponding entry in the table of result values.

If the *first* entry in the argument range is greater than the search argument, i.e., if the search argument cannot be matched against any entry in the range, the result of the function is NA or Not Available.

To illustrate the use of this function, we'll list the first ten entries in the periodic table of the chemical elements, with their atomic weights and atomic numbers. Clear the sheet **/CY/GFL** and type the following

ELEMENT▶WEIGHT▶NUMBER®
>**A2®**
H▼HE▼LI▼BE▼B▼C▼N▼O▼F▼NE®
>**B2®1▼4▼7▼9▼11▼12▼14▼16▼19▼20®**
>**C2®**
1▼1+▲®/R:C4.C11:R
>**A13®**
10.9▶@L(◀,B2.B11)®

The result of the @LOOKUP function at B13 should be 4. Given an experimental atomic weight of 10.9, the @LOOKUP function compared this value against successive values in column B, stopping at the value 11 at B6 which was greater than 10.9. Thus, the atomic weight of 9 at B5 is the matching value, and the corresponding entry, the atomic number in column C, is 4.

If you change the value to be looked up with **◀12.1®** the function result will become 6. If you then type an "atomic weight" of **0®** the result of the @LOOKUP function will be NA.

The @ABS and @INT Functions both accept a single argument, an expression. @ABS finds the "absolute value" of its argument: For example, @ABS(1)=1, @ABS(−1)=1, and @ABS(0)=0. @INT finds the "integer portion" of its argument, without any rounding. You can think of the @INT function as setting every digit to the right of the decimal point to zero.

For example, type **/CY** to clear the screen, then enter **/FI1.7▶@I(◀)®** At A1, the value 1.7 is rounded up to 2 by the local format integer; but at B1, @INT finds the integer portion of 1.7, i.e., 1.0 or 1.

Transcendental Functions and Graphing

So far, we've covered all of the built-in functions except for the transcendentals such as @EXP, @LN and @SIN, and all of the formatting options except for the "graph" format /F*. We'll illustrate these two features together with a more complete example. Our goal is to produce graphs of the transcendental functions. We'll have to do this within the limits of the /F* formatting option, which is really designed to draw simple bar graphs in a column alongside other columns of numbers.

Clear the sheet for an example with **/CY** and type **1↓3↓6↓20®** followed by

>A1®

The "star" format /F* simply displays the number of asterisks equal to the integer portion of the value of the entry where the format is set. Type **/F*** at A1. In place of the (right-justified) number 1, a single (left-justified) asterisk appears, after the usual leading blank.

Now press **↓/F*** The value 3 is replaced by three asterisks. Continue with **↓/F*↓/F*** Position C1 shows six asterisks, while position D1 shows eight (the maximum for a nine-character column).

Type **/GC12®** and notice that position D1 now displays 11 asterisks. Now clear the sheet again with **/CY**

To graph a function, we must first supply a series of argument values for the function and calculate the function result for each argument value. For simplicity's sake, we'll begin with a linear function, e.g., *f(x)=2.5*x*. Type the following

>A20®
.1→.1®
>A1®
+A20↓+↑+B20®
/R:↓.A17:RN

On row 20, we have defined a "start" value and "step" value for our list of function arguments. Then, using formulas and the replicate command, we calculated the argument values, from .1 to 1.7 in positions A1 to A17. Next, we'll calculate the corresponding function results for our linear function. Type the following

>B1®
2.5*A1®
/R:↓.B17:R

The function results are .25, .5, .75, etc., up to 4.25. To see how this looks in the star format, we'll set the format specification and replicate again.

Type **/F*/R:↓.B17:R** How does the "graph" look? It's probably not the kind of graph you had in mind. The problem is that the function results do not fall conveniently in the range 1, 2, 3, etc., which would yield one, two, or three asterisks.

Let's go back to a numeric display with **/FD/R:↓.B17:R** How can we create a better star format display?

First, we'll set up a wider column in which the asterisks may appear so that we can represent a wider range of function results with the best possible resolution. This will allow us to display a "bar" of up to 17 asterisks. Then we'll "scale" the function results, from .25 to 4.25, into the range 0 to 17. Type the following

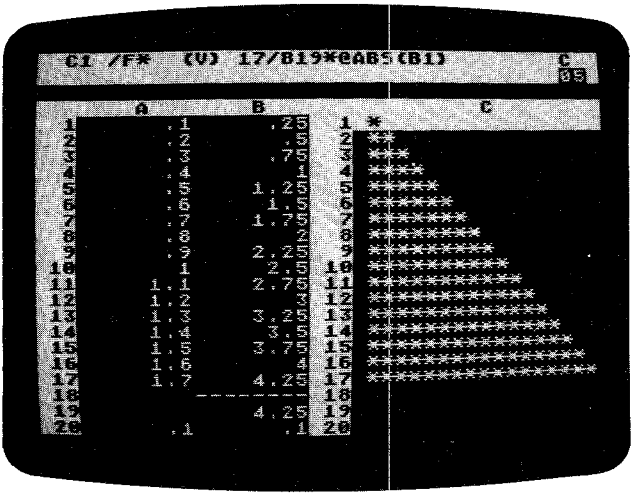
>B18®
/——↓@MAX(B1.B17)®
/GC8®
>C1®
/WV;/GC18®
17/B19*@ABS(B1)®

At B19, we've used the @MAX function to find the upper limit on the range of function results. For simplicity's sake, we'll work with the absolute magnitudes of the function results, so the lower limit will be zero. You may wish to work out an approach to scaling which uses both @MAX and @MIN. We've also set up a wide column in the right hand screen window for the asterisks.

The formula at C1 is used to multiply each function result, such as B1, by the factor 17 (the maximum number of asterisks) divided by B19 (the maximum function result). The value of this formula will lie in the range from 0 to 17/B19*B19, or 17.

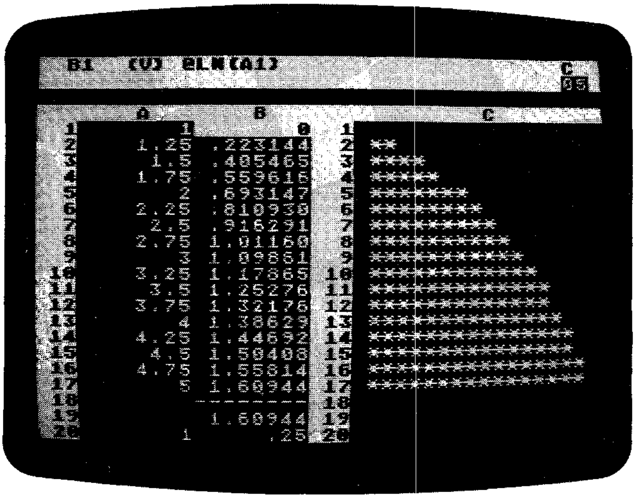
Now type **/F*** to set the display format at C1, and type **/R:→.C17:NR** and watch the screen.

Your screen should look like the photo below, a reasonably approximated straight line. Moreover, if we've done our job properly, we should be able to graph any set of function results in column B, not just the linear function *f(x)=2.5 * x*. We will want to adjust the argument range so that we can graph an interesting portion of the function result range.



Now type the following

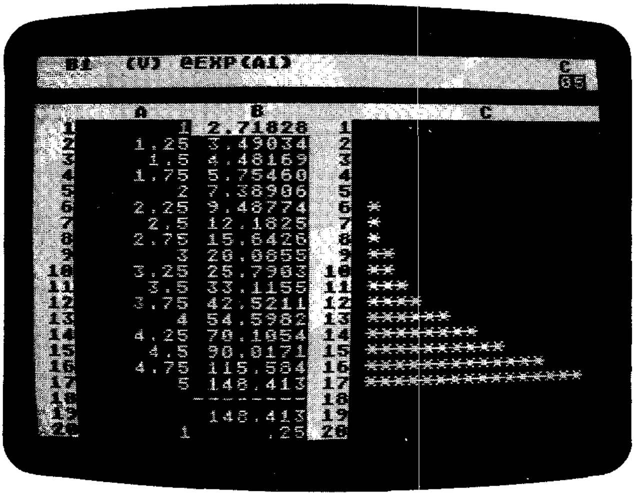
;>A20®
1↓.25®
>B1®
@LN(A1)®
/R:B2.B17:R



Notice that the value of @MAX(B1 . . . B17) at B19 changes to 1.60944. This value affects the formulas in column C so that the results still come out in the range 0 to 17. If the graph of the natural log function doesn't look completely familiar, tilt your head sideways and imagine the X axis on the column and the Y axis on the row.

Now, let's try the exponential function. Type

> **@EXP(A1)®**
> **/R:B2.B17:R**

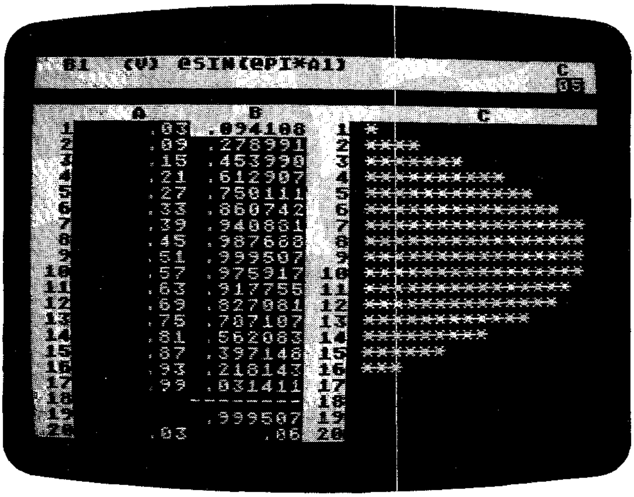


The maximum function result value is now 148.413, and each result is scaled into the range 0 to 17 in column C. Is the graph close to what you expected?

Finally, we'll graph the sine function. Since the trigonometric calculations are done in radians, we'll use @SIN(@PI*A1) and a different argument range so that we can obtain a full sine curve in column C. Type the following

>A20®
.03▸.06®
>B1®
@SIN(@PI*A1)®
/R:B2.B17:R

If all has gone well, you'll have a reasonable graph of the sine function in column C, looking like the photo below.



At this point, you may wish to experiment with different argument values and functions. When you're finished, you can go on with the next section.

Manual and Automatic Recalculation

If you've just worked through the above example at your keyboard, graphing the transcendental functions, you've probably noticed some significant delays as VisiCalc repeatedly recalculated the results of functions such as @EXP, @LN and @SIN.

Because the function results are calculated to eleven or twelve digit precision, each one takes a fraction of a second to evaluate, and a sheet full of function references can take several seconds to recalculate. This problem gets worse as the amount of information on the electronic sheet increases.

In many cases, you don't actually need to have all of the values recalculated every time you change an entry. It would be convenient if you could change several entries and then trigger a recalculation when you're ready to look at the results. VisiCalc lets you do this with the /GR command.

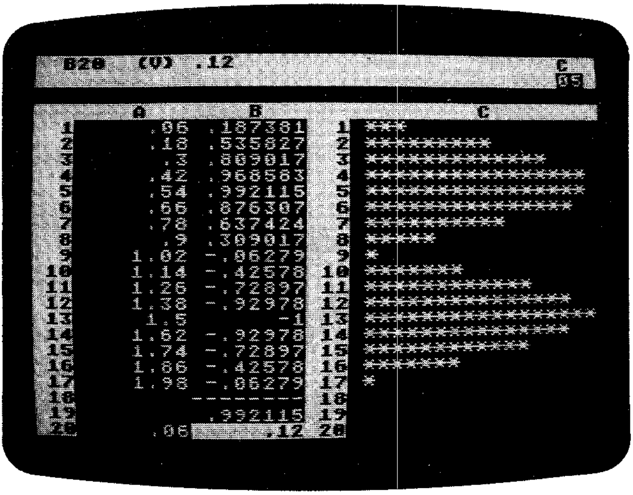
If you still have the graph of the sine function from the previous section on your screen, we'll try changing the argument range start and step sizes. If you no longer have this graph on the screen, you can just read along.

Type >**A20**® to move the cursor to the starting value, which is currently .03. When you load the VisiCalc program or when you clear the sheet, you are in *automatic recalculation* mode. As soon as you change the value at A20, VisiCalc will automatically recalculate the values of all the formulas on the sheet.

Before doing this, however, type **/G** The prompt line reads GLOBAL: C O R F. Press **R** Now the prompt line reads RECALC: A M. The possible keystrokes are M, to switch to manual recalculation mode, and A, to return to automatic mode.

Press **M** You have "turned off" automatic recalculation. Now you can change the values at A20 and B20 without waiting for a lengthy intervening recalculation. Type **.06►.12**® Now we're ready for a recalculation—just press the exclamation key **!**

As you've probably noticed before, an exclamation point appears in the upper right corner of the screen while the recalculation takes place. Whether you're in manual or automatic mode, pressing **!** triggers a recalculation of all formulas on the screen (unless **!** is pressed while you're entering a LABEL or VALUE on the edit line). Notice how the graph changes to display the positive-going portion and the reflection of the negative-going portion of the sine curve.



Now, type **.06◄.54**® then return to automatic mode by typing **/GRA** The first thing that happens as you return to automatic mode is a recalculation to update all the figures on the screen.

Summary

This lesson has introduced you to the full power of VisiCalc's calculation capability. Besides simple addition, subtraction, multiplication and division, VisiCalc provides exponentiation, transcendental functions, and scientific notation for numbers.

You can use functions such as @SUM, @MIN, and @MAX to manipulate entire rows, columns, or other ranges of numbers at once. Functions like @COUNT, @AVERAGE, @NPV, and @LOOKUP allow you to quickly handle common problems such as test score averaging, evaluating the terms of a loan, or looking up figures in the income tax tables.

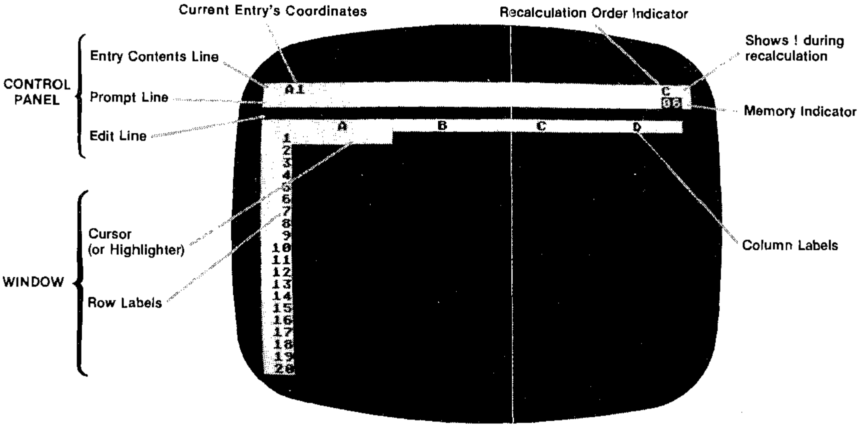
You can control the format of calculated results in a variety of ways—even creating simple graphs with the /F* format. With practice, you'll be able to use the features described in this lesson in combination with VisiCalc's screen and window control and formula replication capabilities to solve complex problems quickly and easily.

Lesson Four concludes Part II, the Tutorial for VisiCalc. The next section, Part III, is the VisiCalc Command Reference. The Reference section contains in-depth discussions of all the commands you've used in the Tutorial, including the fine points of VisiCalc and illustrative examples. Both are helpful in putting VisiCalc to work in your own applications.

After you've had a chance to read this manual and use VisiCalc for some of your own applications, we'd appreciate it if you would fill out and send in the Reader Critique at the back. We're interested in corrections and suggestions for the manual, as well as suggestions for improvements in VisiCalc itself. In the meantime, we hope you find VisiCalc to be an enjoyable and useful tool.

PART III. VISICALC COMMAND REFERENCE

The VisiCalc Screen



The Control Panel

The top three lines of the VisiCalc screen make up the **control panel**. Each line has a specific function:

The **entry contents line** is the top line of the panel. At the left, it always shows the coordinate on which the cursor is currently placed. Next to the cursor it displays the exact content (as it was entered) of that entry position, if there is anything written in it. Any explicit formats (see Part III, the FORMAT Command) that might have been set at the coordinate are also displayed here. At the right side of the entry contents line, the letter **C** or **R** appears, indicating that calculation and recalculation is being done down columns or across rows (see Part III, the GLOBAL Command).

The **prompt line** is the middle line in the control panel. At the left side, it displays the prompts for the command that is currently being used. The number on the right indicates the amount of available memory left in the computer. On the command structure chart at the beginning of each command discussion in the VisiCalc Command Reference, each prompt line is enclosed in a box. Below the box are all the possible actions VisiCalc can take from that point in the command structure.

The control panel is said to be "cleared" when there is no prompt on this line. A command can be started only when this line is clear. (The memory indicator on the right will always be visible.) When a command is being used and there is a prompt on this line, pressing **BREAK** will cancel the command and clear the prompt line.

The **edit line** is the bottom line of the control panel. It displays each character you type or point to with the cursor while using a command. A small rectangle always appears after the last valid character that was typed. Characters that are displayed on the edit line can be erased by backing up the small rectangle with the **BACK S** key and then retyping, if desired. VisiCalc will also, on occasion, use this line to display information that it wants you to confirm or clarify before it carries out a command.

The Window and Sheet
Below the control panel is the VisiCalc **window**, which looks upon a portion of the VisiCalc electronic sheet. Across the top of the window there is a border of letters, each of which is a column label. The sheet is divided into 63 columns, labeled A, B, C, . . . BI, BJ, BK. Down the left side of the window there is a border of numbers, which serve as headings for each row. There are 254 possible rows on the VisiCalc sheet.

Entry Positions
The intersection of each column and row defines an **entry position**. A column letter followed by a row number identifies each entry position, i.e., D17. This identifier is called the entry position **coordinate**.

The Cursor
When VisiCalc is loaded, there is a light bar highlighting entry position A1. This bar is called the **cursor** and sometimes the "highlight." Any command that performs an action on a single entry position will do so in the entry position that is highlighted by the cursor when the command is started. This coordinate remains displayed at the left side of the entry contents line until the command is completed and the cursor moved. During the course of some commands, however, the cursor can be moved by using the arrow keys (an action called pointing).

Moving the Cursor
The cursor can be moved to any position on the electronic sheet. The exact keys that cause the cursor to move are discussed in detail in Part I of this manual, in the section entitled "Some Notes on Your Keyboard." In the VisiCalc Command Reference, we continue to use the symbols ↓, ↑, ←, and → to indicate the use of these keys to move the cursor. The cursor will move one entry position in the direction of the arrow each time you press the cursor-moving key.

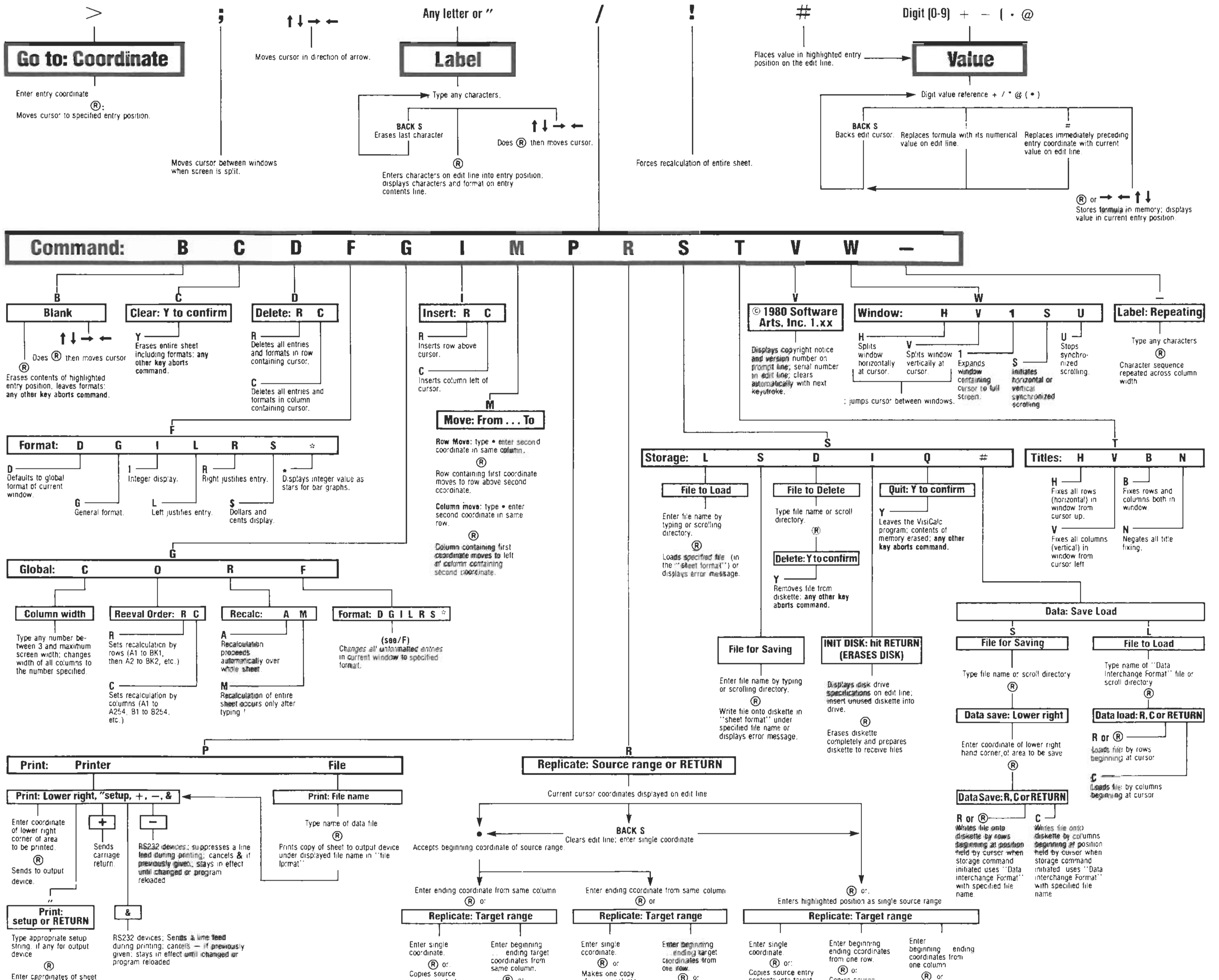
When the cursor has been moved to the right or bottom edge of the sheet visible through the window, VisiCalc will **scroll** the entire window across or down the sheet, following the cursor so that it is in view at all times. To jump around the sheet quickly, see Part III, the GO TO Command.

If the cursor is "bumping" into any of the four edges of the electronic sheet, the ATARI will make the thud noise.

Automatic Repeat
Pressing any key, including the arrow keys ↓, ↑, →, or ←, and *holding* it down will cause that key to repeat its character automatically. In the case of the arrow key, this will cause the cursor to move in the direction of the arrow more quickly. The window will scroll to keep up with the cursor.

Pointing with the Cursor
Whenever you are using a command and can type in a formula (see the VALUE ENTRY Command) or an entry position coordinate, VisiCalc allows you to move the cursor to **point** to the coordinate you want. Check the prompt and edit lines to be sure you have begun the command and that VisiCalc is waiting for you to enter a coordinate before you press one of the cursor-moving keys. Then move the cursor to the desired entry position. You will see the coordinate on the edit line change as you move the cursor. If you try to point with the cursor when it is not allowed, VisiCalc may end the command and move the cursor to the next entry position.

VISICALC COMMAND STRUCTURE CHART



Typeahead
At times, you may type faster than VisiCalc reacts to your keystrokes. This is because VisiCalc may be doing any number of things in reaction to the last key you pressed, such as expanding the electronic sheet and recalculating formulas. VisiCalc has a feature called **typeahead**. Typeahead remembers which keys you pressed, no matter how fast you go. It will catch up with you as soon as it can.

Correcting Mistakes
When you have characters on the edit line, you may back up to erase them by using the **BACK S** key and then typing in the correct characters. Each time **BACK S** is pressed, the small rectangle on the edit line will erase one character. If you press it one more time than you have characters on the edit line, VisiCalc will automatically cancel the command and leave you with a clear control panel.

If you start a command and decide you don't want to complete it, press **BREAK** to cancel it and return to a clear control panel.

To change the contents of an entry position, move the cursor to the coordinate, and initiate the desired command. When you finish the command with its appropriate terminator (such as ®), the old contents will be replaced by the new.

The Memory Indicator
The number at the right side of the prompt line is called the **memory indicator** and tells you how much memory is available as you write on the electronic sheet. There is a discussion of the computer's memory and the way VisiCalc uses it in Part II, Lesson Two, in the sections entitled "Postscript: Memory and the Electronic Sheet," "How the Sheet is Reconfigured," "The Memory Indiator," and "Dynamic Memory Allocation."

The GO TO Command

>

Go to: Coordinate

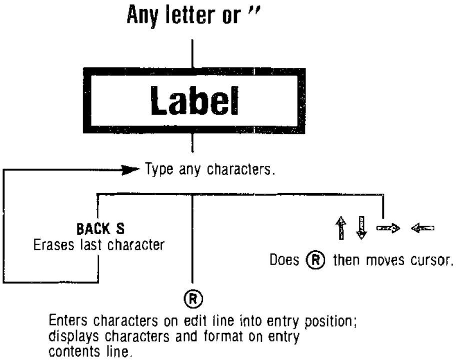
Enter entry coordinate
®:
Moves cursor to specified entry position.

With this command, you have a fast way to move the highlight to any position on the sheet. To move the highlight cursor to a new entry position, type > plus the coordinates of the entry position to which you want to jump, and ®

Example

1. Type >	prompt line:	GO TO: COORDINATE
2. Type **AM205®**	The highlight will be moved to column AM, row 205.	

The LABEL ENTRY Command



Any combination of characters other than control characters can be put into an entry position. The character strings entered as labels are evaluated by VisiCalc as 0 (zero).

You begin the label entry command from a cleared control panel. The label will be entered in the entry position on which the cursor is sitting when you begin the label entry command. When the first character of the label is alphabetic, just begin typing the label. VisiCalc immediately recognized that you are entering a label.

You may want to enter a label such as 2ND MONTH. In such a case where the first character is a digit or one of the arithmetic operators which automatically begin a value entry (see VALUE Command), you must type a quotation mark (") as the first character in the label. The " will not appear as part of the label.

As soon as you have pressed either the " or a letter, the prompt line will display LABEL and the characters of the label will appear in the edit line and in the entry position. Press **BACK S** to back over any mistyped characters. With the error(s) thus removed, simply type in the correct characters.

When the label is complete, terminate the command with either ®, ←, →, ↓ or ↑. The label will appear in the entry position with the first character at the left side of the column and will have replaced anything that you may have previously placed in that position. You may tell VisiCalc to display the label right-justified within the column with a special format (see the discussion of /FR in Part III, the FORMAT Command). All entries made with the label command are given the entry type L, which appears on the entry contents line as (L).

Example

1. Type >**A1**	The cursor is in entry position A1.	
2. Type **P**	prompt line:	LABEL
	edit line:	P
3. Type **ERIOD**	entry contents line:	A1
	prompt line:	LABEL
	edit line:	PERIOD

4. Press ®	entry contents line:	A1 (L) PERIOD
	prompt line:	clear
	edit line:	clear
or press ▶ ▼ ◀ or ▲	The label is entered and highlight is on the next entry position.	

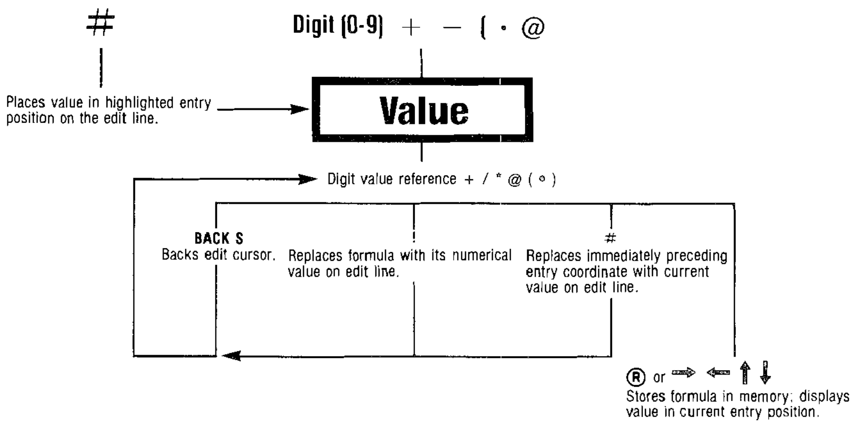
Suppose you want to use a label that looks like a formula.

Example

1. Type >**B1**®		
2. Type "	prompt line:	LABEL
3. Type **.575*B2**	prompt line:	LABEL
	edit line:	.575*B2
4. Press ®, ▼, ▲, ▶ or ◀	entry contents line:	B1 (L) .575*B2
	prompt line:	clear
	edit line:	clear

The (L) on the entry contents line in step 4 of the above example indicates a label type of entry and allows you to distinguish it from a value entry.

The VALUE ENTRY Command



Value entry is the procedure by which you write numbers and formulas on the VisiCalc sheet. A formula may be a number or an arithmetic expression and may contain entry position coordinates (called **value references**) as well as functions and their arguments. For example, 1000, +B13, 1.5*12/6, +C2*B2 and 1.5+(D2/B3) are all valid formulas. You can enter values in either of two ways:

1. By typing the appropriate characters directly at their coordinates and pressing ®;
2. By using the arrow keys (← → ↓ ↑) to move the cursor to a coordinate where you have previously placed a value or formula and pressing ®.

When a formula contains a value reference, VisiCalc uses the current value in the entry position in its calculation. VisiCalc then displays the calculated **value** of the formula in the entry position on which the cursor is located when you start the command. When a value has been entered, it replaces the previous contents of the entry position.

All values are stored with either 11 or 12 significant digits. When a number is displayed in the general format (see the FORMAT Command), VisiCalc will shift between conventional and scientific notation as required to display the calculated value with the greatest precision.
In scientific notation, the number 123456789123 becomes 1.235E11. The "E11" means "times 10 to the 11th power." The largest number possible is .999999999999E62. The smalles is 9.999999999E−66. Except in $ format (see the FORMAT Command), non-significant zeros are dropped from the display.

If the column is too narrow to display the number even in scientific notation, VisiCalc will place as many right angle brackets (>) as it can in the entry position.

An illegal calculation, such as dividing by zero, will result in a value that is displayed as ERROR in the position where the illegal calculation occurs and in all other positions that reference the calculation.

Any of the following keystrokes will initiate the value entry command: a **digit** + – (. # @

The arithmetic operators are:

- \+ addition
- – subtraction
- / division
- * multiplication
- ^ exponentiation

VisiCalc performs the calculations in the order it encounters them, from left to right. To change the order of precedence, use parentheses to indicate "do this first." If there are parentheses within parentheses, VisiCalc will calculate the innermost first. For example, 5+6/2*4 will be evaluated as 22, but 5+((6/2)*4) will evaluate as 17.

The complexity of a formula, i.e., the number of value references, arithmetic operators, parentheses, functions and their arguments, and the amount of memory in your computer determine the maximum length of the formula you may enter. If the formula becomes too complex as you type it, VisiCalc will stop displaying your keystrokes. You will be able to enter everything in the formula up to that point. VisiCalc will not allow you to enter an illegal formula such as one which ends with an arithmetic operator. You must back up with the **BACK S** key to erase the offending character(s).

A formula that does not contain value references may be one such as 1435, or –14.35 or 5*12+1–60. As soon as you type one of the characters that initiate a value entry (as listed in the first paragraph), VisiCalc immediately places VALUE on the prompt line and displays the character you typed on the edit line. As you continue to type in the elements of the formula, they appear on the edit line. Until you have terminated the command and entered the formula by pressing ® or one of the cursor-moving keys, you can use **BACK S** to modify what you've typed, or press **BREAK** to leave the value entry command altogether.

When a value entry formula has been made, VisiCalc displays the calculated value at the entry coordinates on the sheet and the formula itself on the entry contents line of the control panel. It also stores the actual formula in its memory. The formula that was used to obtain a value will always be displayed on the entry contents line when you place the cursor on the value. For example, if 5*12+1–60 were the value entry, the entry position would display 1, its calculated value. At the same time the entire formula would appear on the entry contents line.

VisiCalc may also be used like a calculator as you are typing in a formula on the edit line. Suppose you wanted to store the result of 5*12+1–60 as the value entry, and not the formula from which it was derived. Simply type the formula at whatever coordinate you choose. You will see the formula on the edit line as you type it in. When you've finished typing in the formula, press the exclamation point ! VisiCalc will immediately calculate the value and display the result on the edit line.

If ® or one of the cursor-moving keys is pressed at this point, the answer (in the case of the above formula, number 1) will appear at the entry position coordinates and in the entry contents line. From this point, you could also continue developing the formula for the value entry.

VisiCalc provides a method for duplicating a numerical value from one entry position into another without having either to retype or replicate the formula (see the REPLICATE Command). Note, however, that this method uses only the calculated value in the entry position as the new value entry, not the original formula.

To begin, place the cursor at the position into which the number is to be entered, and initiate the value entry command with +. Then, either point with the cursor or type in the coordinate of the entry position containing the number you wish to duplicate. The edit line will display the coordinate. Press #, and the *value* of that coordinate will appear on the edit line. Press ® or move the cursor, and the value will be entered into the entry position.

Example

1. Type **/CY**	Clear sheet; cursor to A1	
2. Type **1**	prompt line:	VALUE
	edit line:	1
3. Press ®	entry contents line:	A1 (V) 1
	prompt line:	clear
	edit line:	clear
	position A1:	1
4. Press ▶	entry contents line:	B1
5. Type **3*34**®	entry contents line:	B1 (V) 3*34
	prompt line:	clear
	edit line:	clear
	position B1:	102
6. Type **▶8*1.5!**®	entry contents line:	C1 (V) 12
	position B1:	12
7. Type >**B5**®	entry contents line:	B5
8. Type +	prompt line:	VALUE
	edit line:	+
9. Press ▲ until the cursor is highlighting B1	edit line:	+B1
10. Press #	edit line:	+102
11. Press ®	entry contents line:	B5 (V) 102
	prompt line:	clear
	edit line:	clear
	position B5:	102

VisiCalc permits entry position coordinates to be used as elements in formulas. These elements, called **value references**, take on the value in the entry position to which they refer. This value will change whenever you change the contents of the referenced entry position. You cannot begin a formula with a value reference, since the first character you would type would be a letter. VisiCalc would assume you were typing a label (see the LABEL ENTRY Command).

You must initiate the value entry command with a +, or 0+ and enter the value reference. If the next keystroke is an arithmetic operator, you may follow it with a number or a value reference.

Until you've terminated the value entry command with ®, ↓, ↑, ←, or →, you can use **BACK S** to back up and change the formula on the edit line, or press **BREAK** to interrupt the command and return to the cleared control panel without making an entry.

If you are looking at different parts of the sheet through a split screen (see the WINDOW Command), you can use the ; to jump from one window to the other and point to entry position coordinates you wish to use in the formula.

A cursor-moving key (↓, ↑, ←, or →) will not terminate the value entry command, if you type it simply to point to a value reference that follows an arithmetic operator on the edit line. Rather, pressing an arrow key will simply change the coordinate on the edit line to show the new cursor position. You must use a ® to establish the pointed to value reference as part of the formula you are attempting to create.

For example, if 1+ is on the edit line, and you point with the cursor to A5, the formula on the edit line will be 1+A5. Pressing a cursor-moving key at this point will not terminate the command, but will change the coordinate A5 to correspond to the new cursor position. In this example, ® must be used to enter the formula.

If you press # immediately after a value reference on the edit line, the value of the coordinate will replace the value reference on the edit line. Pressing ! will evaluate the entire formula before it is entered into an entry position, automatically replacing every value reference that is on the edit line with its current value.

Press ® or any of the cursor-moving keys after # or ! will enter the value of the formula rather than the formula itself in the entry position. Note that the resulting value will appear in both the highlighted entry position and the entry contents line. The original formula will not be saved.

Example

1. Type **/CY**	Clear sheet; cursor to A1	
2. Type **1↓**	position A1: Cursor is on A2.	1
3. Type **+**	prompt line: edit line:	VALUE +
4. Press **↑**	edit line:	+A1
5. Type **+1**	edit line:	+A1+1
6. Press ®	entry contents line: position A2:	A2 (V) +A1+1 2
7. Type **↓1+↑#**	edit line: The value of A2 has replaced the value reference.	1+2
8. Type **!**	edit line: The formula on the edit line has been evaluated.	3

9. Press ® entry contents line: A3 (V) 3
position A3: 3
Notice that the formula used to derive the value of 3 has not been stored because of the use of !.

In the example above, every time you change the value of A1, you will see the effect of that change in position A2, which contains A1 as a value reference in the formula +A1+1. Try it by placing the cursor on A1 and typing **100®** The value in A2 will be recalculated and replaced with the new value, 101.

Recalculation Order
VisiCalc formulas may contain as many value references as the complexity of the formula will allow. When any value entry is made, including changing an existing entry, VisiCalc automatically recalculates every value on the sheet. Recalculation always starts in the upper left hand entry position, A1.

VisiCalc's natural tendency is to calculate column by column. Given a set of values to work on, it calculates a value for A1, then A2, then A3, then A4 to the end of column A. Then it recalculates B1, B2, B3, B4 to the end of column B; then C1, C2, C3, C4 and so on. Note the letter **C** in the upper right corner of the control panel. This indicates that the order of recalculation for the whole sheet is by column.

The global command (see the GLOBAL command) contains an option which lets you change the order of calculation from down columns to across rows. When row calculation is in effect the upper right corner of the control panel will display an **R**.

Forward and Circular References
Pay particular attention to the placement of any formulas that contain value references. When in the column recalculation mode, be sure that all referenced entry positions are to the left of the formulas that cite them (or above a formula in the same column).

If the sheet is not arranged in this way, the formula containing a value reference will be recalculated before the new value has been placed in the referenced entry position. When recalculation has been completed, the sheet will display the value of the formula as calculated using the *old* value from the referenced entry position. However, the *new* value of the referenced entry position will be displayed in the entry position.

This problem, called **forward referencing,** is often difficult to diagnose and might cause you to conclude that VisiCalc has made an arithmetic error. If you suspect your sheet contains a forward reference that is causing a formula to be incorrectly updated, press the **!** once. This will force another recalculation of the whole sheet.

Watch the suspect formula. If a new value appears, look for forward references. You may choose to redesign your sheet to eliminate all forward references or to use multiple **!**'s for recalculation. In row calculation, referenced values must be placed in the rows above the formulas that cite them (or to the left in the same row).

Note that if you forward reference a position and recalculate it, the result should be correct. However, if you save and reload the sheet, the positions containing forward references will display ERROR. To see the correct values after reloading the sheet, you must force another recalculation.

A **circular reference** is one that cites itself, such as placing the formula, 1+A1, in entry position A1, for example. Each time the sheet is recalculated the value of this formula will change, even if no other changes are made on the sheet. Circular references can be very useful when their results are correctly anticipated. However, they can create real problems when entered by mistake.

VisiCalc's Built-In Functions

Built-in functions are used within value entries to save you the effort of setting up commonly used formulas yourself. Each function begins with @, followed by the "function word," followed by an expression in parentheses (the argument). For example, the @SUM function might be written

```
@SUM(B1,S2,A4*.23)
```

This expression would result in the sum of the values found in entry positions B1, S2, and .23 times the value in entry position A4. A built-in function may be placed in any entry position by itself or used as part of a larger expression.

The @ may be used as the first character in a value entry (no preceding + is necessary). The function word may be shortened to include only enough letters to avoid confusion with other function words. The function words are listed in the table below with the form of their arguments and their definitions.

Function Arguments

All but three of the built-in functions are followed by an argument written in parentheses. The arguments shown as "v" in the chart below may be any legal VisiCalc values. The arguments shown as "list" may consist of any combination of values and entry ranges separated by commas. A range is a portion of a row or a column specified by its beginning entry position coordinate, three dots, and its final entry position coordinate.

Example: `A3 . . . A17`

A range may not be a diagonal across rows or columns. When entering a range, you may type in the coordinate or move the highlight to point at the desired entry position. Entry positions containing labels or blank entries are evaluated as zeros when they are used as value references in function arguments or in formulas.

You may insert values into a range by placing the cursor on any coordinate within the range and typing **/I** followed by **R** (for Row) or **C** (for Column). The @function range will expand to include your insertion.

The only two places where you may not insert a value into a range are at the beginning coordinate of the range and at the @function itself. Either such entry will not be included in the range.

@SUM(list)	adds the values of all entry positions cited in the list.
@MIN(list)	chooses the smallest value in the list.
@MAX(list)	chooses the largest value in the list.
@COUNT(list)	results in the number of non-blank entries in the list.
@AVERAGE(list)	@SUM(list) divided by @COUNT(list)
@ABS(v)	results in the absolute value of v.

@INT(v)	results in the integer portion of v.
@SQRT(v)	results in the square root of v.
@EXP(v)	returns e (2.71828 . . .) to the v power.
@LOG10(v)	results in the logarithm (base 10) of v.
@LN(v)	returns the natural log (base e) of a number.
@SIN(v), @COS(v), @TAN(v), @ASIN(v), @ACOS(v), @ATAN(v)	returns the appropriate trigonometric function of the value. Calculations are done in radians.
@NPV(dr,range)	Calculates the Net Present Value of the cash flows in the range, discounted at the rate specified by dr (the discount rate expressed as a decimal). The first entry in the range is the cash flow at the end of the first period, the second entry is the cash flow at the end of the second period.

Functions without Arguments
@PI is the ratio of the circumference of a circle to its diameter. VisiCalc evaluates @PI as 3.1415926536.

@NA (Not Available) is used when a sheet must be set up before the data to be evaluated is available. If entry positions that will later contain data are left blank, they will be evaluated as zero if used as value references in formulas. This will produce the entry ERROR on the sheet wherever zeros appear as denominators and may produce incorrect or misleading values elsewhere. Entering @NA into the blank data positions causes VisiCalc to evaluate all entries that refer to those positions as NA. Without entering the data, you can be assured that all your formulas are legal in VisiCalc.

Any illegal calculations will show up as ERROR. Like @NA, @ERROR is also displayed in the entry position into which it is entered and all positions that refer to it. In addition, the @ERROR function is often generated by VisiCalc in such cases as when a deleted row or column contained entry positions that are value references in formulas. An ERROR message will also result from a too deep nesting of **(** or of **+**. An expression syntax error, such as NPV with a range, can also generate an ERROR message. Note: it's okay to save sheets that include either ERROR or NA entries.

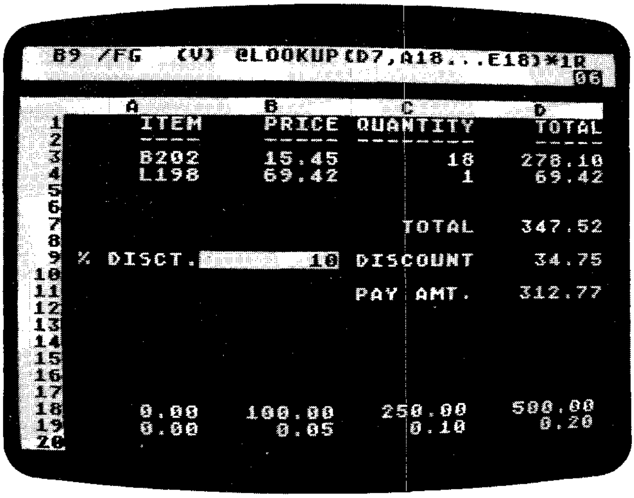
@LOOKUP(v,range)
Looks up a numeric value in a table and finds the value that corresponds to it. For example, when you do taxes, you look up the gross pay in a tax table and then use a corresponding tax rate.

The table used by the @LOOKUP function may be a range within a column or a row. The value that is being looked up will be compared to successive values in that table until a value is found that is larger than the value being looked up (or until the end of the table is reached). The entry in the table that is before this entry is the one that VisiCalc will consider as the "match" for the value being looked up.

If the table is in a column, VisiCalc returns the value of the entry that is immediately to the right of the "matching" entry as the value of the function. If

the table is in a row, VisiCalc returns the value immediately below the "matching" entry as the value of the function. If the first value in the table is greater than the value being looked up, then the value of the function will be NA.

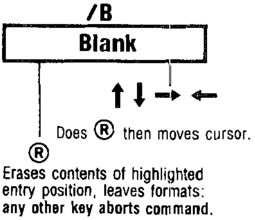
An example of the use of the @LOOKUP function would be the following invoice form. The total amount of the goods purchased is looked up in a table and the found value is used as a discount percentage. Finally, the dollar amount of the discount is calculated, and the total amount of the invoice is found. In this example, the order of calculation is by rows (see the GLOBAL Command, /GO).



The formula at entry position B9 is @LOOKUP(D7,A18 . . . E18)*100 (by multiplying by 100, we make it a percentage). Although the lookup range is technically a forward reference (see the VALUE ENTRY Command), it makes no difference in this case because the values in that range are constants. The format of that entry position is /FG (see the FORMAT Command). The formula at D9 is +D7*B9/100. The lookup table has been placed in positions A18 through E18. The entry at position E18 is $3000.00 referencing a discount of 0.25 at E19.

If the total of the invoiced items was $347.52, then the discount percent would be 10% (the value that corresponds to $250.00). A total of $3000.00 would have a discount of 25%, the same as for $1000.00.

The BLANK Command



Blank erases the label or value at the entry position where the cursor is located without affecting the existing format setting for that position.

Example

1. Move the highlight over the entry position to be erased.		
2. Type /	prompt line:	COMMAND: BCDFGIMPRSTVW–
3. Type **B**	prompt line:	BLANK
4. Press ®	The control panel will clear and the highlighted entry position will be blank.	
or press → ← ↑ or ↓	The control panel will clear, the original entry position will be blank, and the highlight will be on the next entry position.	

The CLEAR Command

/C

Clear: Y to confirm

Y
Erases entire sheet including formats: any other key aborts command.

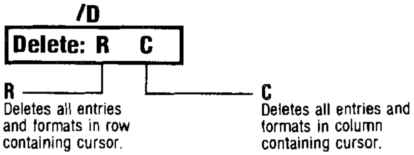
The clear command completely erases the sheet. Clear sets all entry positions to blank, resets formats, titles, windows, and other information about the sheet to the initial specifications set by VisiCalc when you first load it into the computer. The cursor is returned to entry position A1.

Clear **irretrievably erases** all information on the screen. If you want to save the information on the sheet, be sure to do it (see the STORAGE Command) before issuing the clear command.

Example

1. Type **/C**	prompt line:	CLEAR: Y TO CONFIRM
2. Press **Y**	The screen will darken for a few seconds, then display the copyright and version notices. Your next keystroke will clear the prompt line.	

The DELETE Command



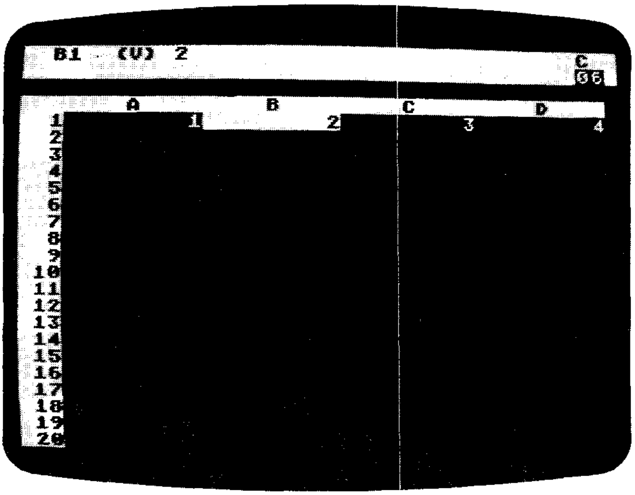
VisiCalc allows you to remove the **entries** from an entire column or row. The delete command will delete the information in the row or the column where you have placed the cursor. After removing the row or column, it then fills in the empty space with the nearest row or column.

VisiCalc also automatically looks up all value references in formulas and changes them to correspond to the new coordinates resulting when the rows or columns are moved after the delete command. It then recalculates the whole sheet.

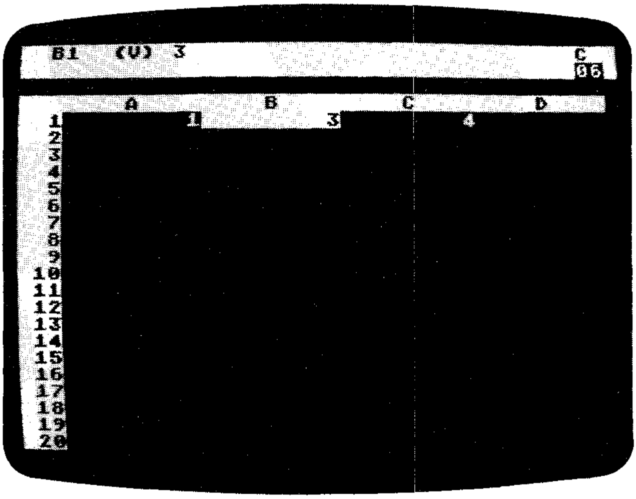
To use this command, first place the cursor in the row or column you want to delete. Then type **/D** The prompt line reads DELETE: R C. Type **R** to delete the row in which the cursor is located. Or type **C** to delete the column. VisiCalc immediately deletes the information and moves all other rows or columns accordingly.

Example

1. Type **/CY** — To clear the sheet. Cursor is at A.
2. Type **1▸2▸3▸1+C1®**
3. Type **>B1®** — Your screen should look like this:



4. Type **/D** — prompt line: `DELETE: R C`
5. Type **C** — Your screen looks like this:



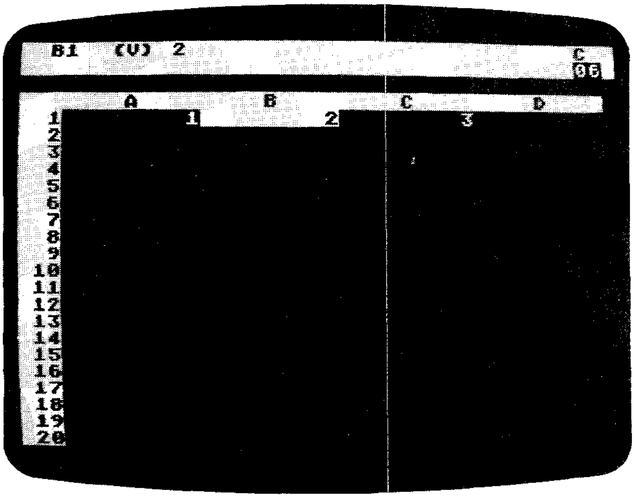
6. Press ▸ — entry contents line: `C1 (V) 1+B1`
Note that the formula has been changed from 1+C1 to 1+B1 so that it still refers to the value at 3 that you originally entered at C1 in step 2 of this example. When the entries in column B were deleted, VisiCalc moved all columns up and then changed the value reference so that the formula is correct relative to the new positions.

Use the delete command with care: *you cannot recover the information from a row or column once you have deleted that row or column*. The insert commands (see the INSERT Command) can recreate the row or column space, but not the actual entries.

If you have deleted an entry that was referenced in a formula (see the VALUE ENTRY Command), all entry positions containing formulas with value references to that position will contain the message **ERROR**.

Example

1. Type **/CY** — To clear the sheet
Cursor is at A1
2. Type **1▸2▸1+B1◂** — The cursor is on B1.
Your screen should look like the photo below:



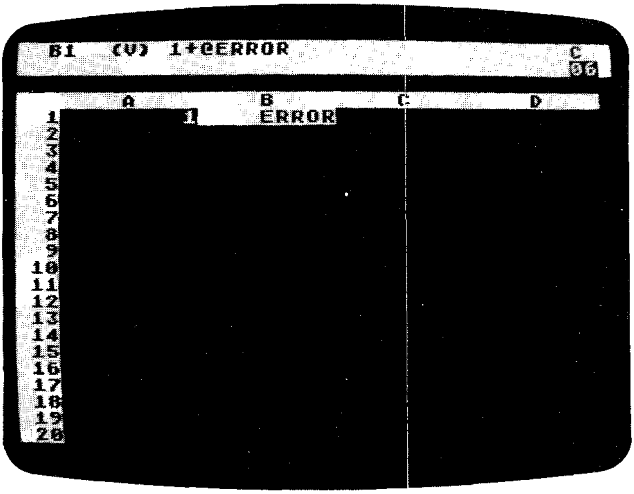
3. Type **/D**
4. Type **C**

prompt line: `DELETE: R C`

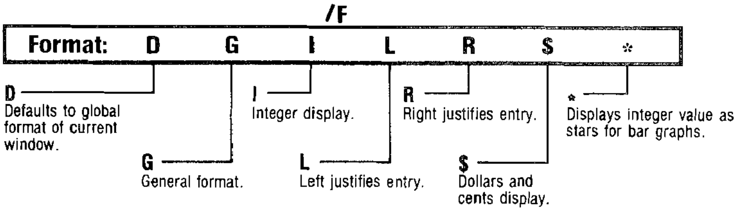
entry contents line: `B1 (V) 1+@ERROR`

position B1: `ERROR`

All information in column B was deleted and the contents of column C move over. At step 2, you entered a formula with a value reference, 1+B1. VisiCalc replaced B1 with ERROR and alerted you by placing @ERROR in the entry position containing the formula.



The FORMAT Command



The format command adds a set of explicit display conditions to the highlighted entry on the VisiCalc sheet. The original entry contents (LABEL or VALUE) remain unchanged in the computer's memory. The original contents will also be stored on diskette (see the STORAGE Command), if you choose to save the sheet. They are always used in calculations and are displayed completely on the entry contents line.

On the sheet, however, the entry will appear as specified by this command. If the entry is moved to another position on the sheet (see the REPLICATE Command, the MOVE Command, and the INSERT Command), printed on paper or another device (see the PRINT Command), or stored on diskette (see the STORAGE Command) the appearance caused by the format command will remain.

Once an entry position has been formatted, a format indicator will appear on the entry contents line between the current entry coordinates and entry contents. Erasing the contents of the entry position (see the BLANK Command) does not remove explicit formats, but clearing the sheet (see the CLEAR Command) does.

To format a row or a column before making entries, format the first entry and then use the replicate command (the REPLICATE Command) to copy the format into the rest of the row or column.

You cannot change the number of character spaces in an individual entry position. To change the number of characters in every column throughout the window, use the global command for changing column width (see the GLOBAL Command).

To see how the format options affect the display, set up your sheet as instructed in the example below. All the examples in this section use this sheet for the format examples.

Example

1. Type /**CY** — This clears the sheet, positions the cursor at A1, and resets all display characteristics.
2. Type **LABEL ENTRY→ 1.23456789→99.999®**

You now have one label and two values on your sheet. Any explicit format settings were removed when the sheet was cleared. You have one window (see the WINDOW Command) and no titles (see the TITLE Command). Your

columns contain nine character spaces, the general column width, (see the GLOBAL Command), and all entry positions display the general format (see the GLOBAL Command and the discussion below). These same display characteristics are set each time VisiCalc is loaded into your computer and whenever the clear command is used.

/**FD** is the **Default** display format

An individual entry position format is changed to whatever format has been previously set with the global command (see the GLOBAL Command). If no global setting is in effect, the default will be the general format, described in /**FG** below.

Example

1. Type >**C1**®		
2. Type /**F$**	The highlighted entry (C1) changes to dollars and cents format; B1 is unchanged. The entry contents line displays the /F setting.	
	entry contents line:	C1 /F$ (V) 99.999
	position C1:	100.00
3. Type /**FD**	entry contents line:	C1 (V) 99.999
	position C1:	99.999
	The default setting is general, as set by /CY.	
4. Type /**GFI**	All values in the window that have *not* re-received an individual format are displayed as integers.	
	position B1:	1
	position C1:	100
5. Type /**FG**	entry contents line:	C1 /FG (V) 99.999
	position B1:	remains in integer format
	position C1:	99.999
	The setting on C1 is now general, as shown on the entry contents line.	
6. Type /**FD**	entry contents line:	C1 (V) 99.999
	position B1:	unchanged
	position C1:	100
	The setting on C1 has been removed and is no longer indicated on the entry contents line. However, since there is a global integer setting in effect, position C1 is displayed in integer format instead of general format.	

/**FG** sets the entry position to the **General** format.

Labels begin in the leftmost space (left justified) and are cut off wherever the column width ends. Values are moved as far to the right as possible (right

justified) with a leading blank character in the leftmost position in the column. Decimal or scientific notation is selected to display the largest number of significant digits.

Example

1. Type >**A1**®	position A1 is now in general format for labels entry contents line: A1 (L) LABEL ENTRY position A1: LABEL ENT
2. Press ▶	position B1: 1 A global integer setting is still in effect from the previous example.
3. Type **/FG**	position B1: 1.234568 General format for numbers with few significant digits.
4. Type **123456789123456789**®	entry contents line: 123456789123000000 position B1: 1.235E17 General format for numbers with many significant digits. VisiCalc selects scientific notation when this permits a larger number of significant digits to be displayed within the current column width.

/FI sets **Integer** format.

All values are displayed rounded to the nearest whole number.

Example

1. Type **1.2**®	entry contents line: B1 /FG (V) 1.2 position B1: 1.2
2. Type **/FI**	entry contents line: B1 /FI (V) 1.2 position B1: 1 Entry contents are rounded to the nearest integer.

/FL Left justifies the entry position contents. All labels begin in the leftmost character space. All values are moved to the left, preceded by one leading blank. This command affects only the display of entries on the sheet that have fewer characters than the current column width. Left justifying a value entry will turn off an explicit integer format (/FI) setting for that entry position.

Example

1. Type **/FL**	entry contents line: B1 /FL (V) 1.2 position B1: 1.2 The value in B1 has been moved to the left.

/FR Right justifies the entry position contents. The last character of a label or a value falls in the last character space of the entry position. This command affects only the display of entries on the sheet that have fewer characters than the current column width.

Example

1. Type **/FR**	entry contents line:	B1 /FR (V) 1.2
	position B1:	1.2
	The value in B1 has been moved to the right.	

/F$ displays values in **Dollars and Cents**. All values are rounded to two decimal places. No $ is displayed in the entry position. Trailing zeros are shown. There is no effect on labels.

Example

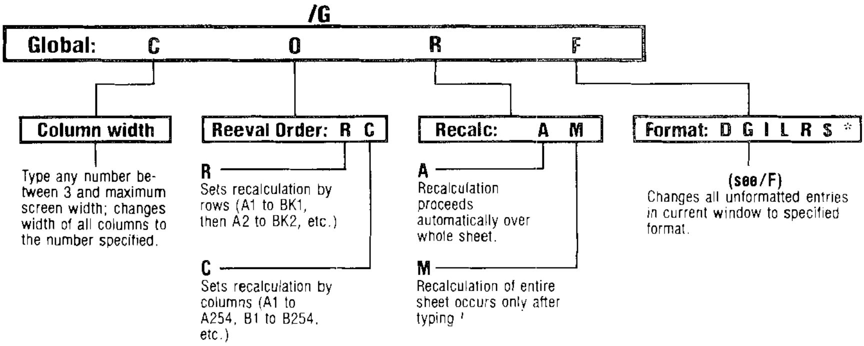
1. Type **/F$**	entry contents line:	B1 /F$ (V) 1.2
	position B1:	1.20

/F* displays **Bar Graph** format. All values are truncated to an integer. That integer is replaced in the entry position by an equal number of stars. If the number of stars is larger than the width of the entry position, extras are ignored.

Example

1. Type **/F***	entry contents line:	B1 /F* (V) 1.2
	position B1:	*

The GLOBAL Command



The four global command options affect the window display and the order in which rows and columns are calculated.

/**GC** (Global Column) allows you to change the width of all columns in a window to any number of characters between 3 and 39 (the maximum width of your screen). Column widths may not be set individually. VisiCalc will display as many whole columns of a given width as possible on the screen. When changing to a single wide column in a window, any vertical title areas previously set will be automatically removed (see the TITLE Command).

When displaying numbers on the sheet, VisiCalc may change the format from the way you originally entered it on the edit line. Numbers will be rounded off in the window display when necessary to fit into the column width. VisiCalc will use scientific notation if this will permit more significant digits to be shown at the current column width than regular decimal notation. If the column is too narrow to display the integer portion of a value in either decimal or scientific notation, VisiCalc will display as many > symbols as will fit in the column width in the entry position with a leading blank.

Regardless of how the values appear on the screen, the numbers stored in the computer's memory will remain unchanged and will be used in all calculations. The number, as you originally entered it on the edit line, will be displayed on the entry contents line whenever the cursor is over that number's entry position. To enter the number appearing on the entry contents line onto the edit line, place the cursor on the entry position and press # The prompt line must be clear to do this.

Example

1. Type /**CY** — This clears the sheet and resets the column width to nine characters.

2. Type in position A1: **THIS LINE IS TOO LONG.®** — entry contents line: `A1 (L) THIS LINE IS TOO LONG.`

3. Type **/G**	prompt line:	GLOBAL: C O R F
4. Type **C**	prompt line:	COLUMN WIDTH
5. Type **18®**	entry contents line:	A1 (L) THIS LINE IS TOO LONG.
	position A1:	THIS LINE IS TOO L
6. Type **/GC24®**	entry contents line:	A1 (L) THIS LINE IS TOO LONG.
	position A1:	THIS LINE IS TOO LONG.
	position B1:	not displayed

Example

1. Type **/CY**		
2. Type **123456789®**	entry contents line:	A1 (V) 123456789
	position A1:	1.2346E8
	Note the leading blank, scientific notation, and final digit rounded up.	
3. Type **▸1.23456789®**	entry contents line:	B1 (V) 1.23456789
	position B1:	1.234568
	Note the leading blank and the final digit rounded up.	
4. Type **/GC3®**	entry contents line:	B1 (V) 1.23456789
	position A1:	>>
	position B1:	1.
	The number in A1 is too large to express with two characters, which is the space available for digits when the column width is 3, so VisiCalc displays >>. The number in B1 is rounded as shown with decimal point appearing.	

/GO (Global Order of recalculation) allows you to set the Order of Calculation to Columns or Rows. In column calculation and recalculation, entry position A1 is evaluated, then A2, A3 to the bottom of the sheet, then B1, B2, B3, to the bottom of the sheet in this column, then C1, C2, and so on. In row calculation, A1 is first, then B1, C1, and so on, to the right hand end of the sheet, then A2, B2, C2, and so on, to the end of the sheet. This order of calculation is indicated on the control panel by the letter C or R in the upper right hand corner of the entry contents line. When you first load VisiCalc, the calculation order is by column.

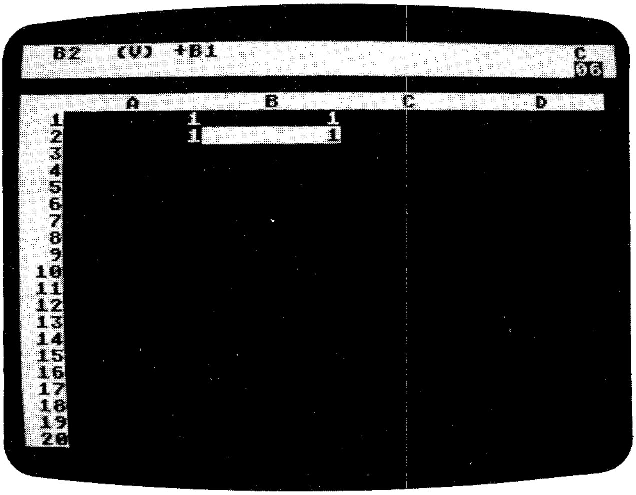
If VisiCalc appears to evaluate formulas incorrectly, you have probably placed formulas in entry positions so that they are calculated before the value refer-

ences that they contain. Order of calculation and recalculation has been discussed at length in The VALUE ENTRY Command in Part III, and also in Part II, Lesson Three, in the section entitled "The Order of Recalculation."

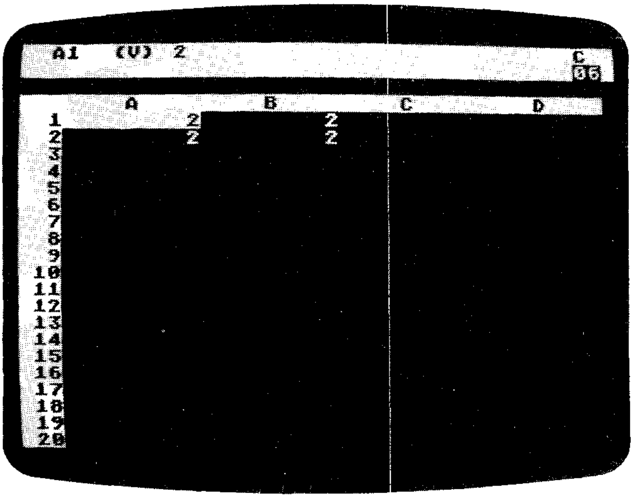
The following example illustrates the use of value references set up for column calculation, and shows what happens when they are calculated in by row.

Example

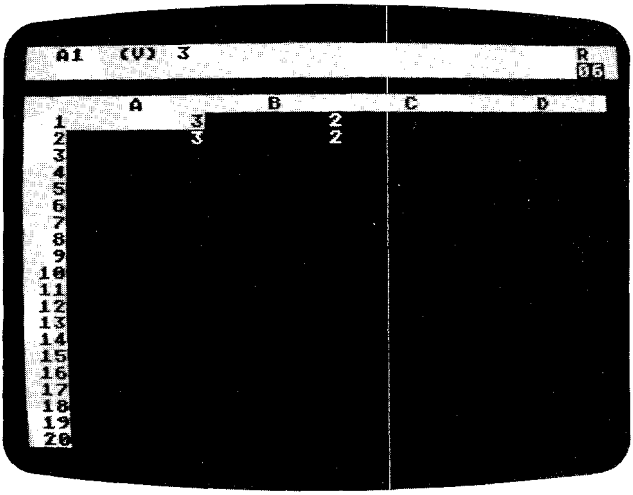
1. Type **/CY** — This clears the sheet and sets column calculation.
2. Type **1**⬇
3. Type **+A1**®
4. Type **>B1**®
5. Type **+A2** ⬇
6. Type **+B1**® — Your screen should look like this:



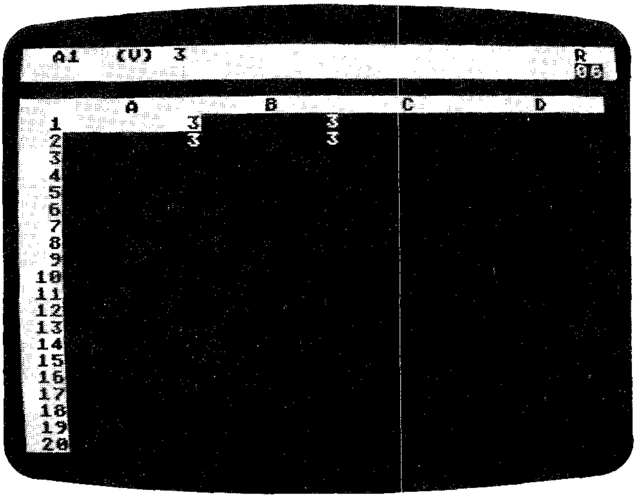
7. Type **>A1**®**2**® — The value at A1 is changed to 2, and the other values are recalculated. Your screen should look like this:



8. Type **/GOR** — The order of calculation indicator changes to R.
9. Type **3®** — Your screen looks like this:



This is incorrect. B1 should be the same as A2, yet it displays a different value because B1 was recalculated *before* A2 was recalculated. In such instances, you can force a recalculation by pressing **!** when the prompt line is blank. Press it now and the screen shows the correct values as in the photo below.



A similar example that works correctly for row order of calculation, but not for column order, is this:

Example

1. Type /**CY** — The sheet is cleared and calculation is set to column order.
2. Type /**GOR** — To change to row order of calculation.
3. Type **1➧+A1**®
4. Type >**A2**®
5. Type **+B1➧+A2**®

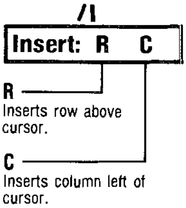
Note how the four coordinates relate differently than in the previous example. Type >**A1**® Now type in **2**® and **3**® The results are correct. Change the order of calculation to columns with /**GOC**. Now type in a **4**® at A1. An error results, similar to the one in which a column-oriented group of numbers were recalculated by rows.

/**GR** initiates Automatic or Manual Recalculation. When first loaded, VisiCalc is set to recalculate all values as soon as any change is made in an entry position to which a formula may refer. Changes ripple rapidly across your sheet whenever you change a value. Sometimes, such as when you are typing in a column or row of figures, you would like to turn off recalculation completely to eliminate the pause that occurs when VisiCalc is recalculating.

To turn it off, type /**GRM** which stands for Global Recalculation Manual. Under manual recalculation, only the highlighted formula will be recalculated automatically. To update the whole sheet you must type **!** Note: The use of **!** does not take you out of manual recalculation. There is no cue on the control panel to indicate whether you are in manual or automatic recalculation, but the status should be evident from watching the behavior of the sheet. To resume automatic recalculation, type /**GRA** (Global Recalculation Automatic).

/GF (Global Format) allows you to assign a format setting for all entry positions in the window which have not been individualy formatted. The global format command uses the same formatting options as are available for individual entry positions. See the FORMAT Command for an explanation of these options. If you have split your screen into two windows (see the WINDOW Command), you may use a different global format for each window. When you save your sheet with /SS all global formats are also saved (see the STORAGE Command).

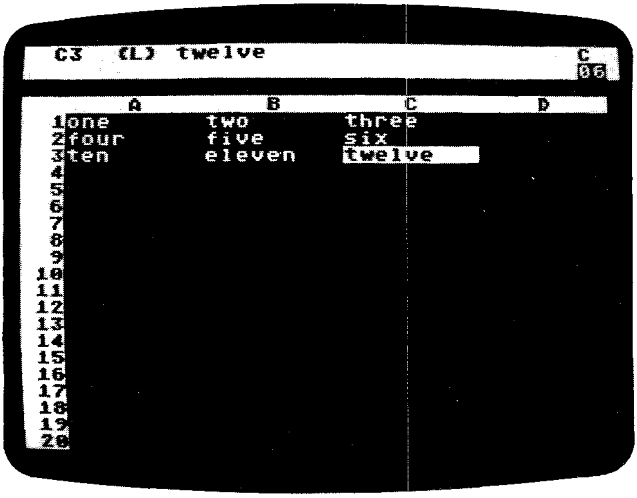
The INSERT Command



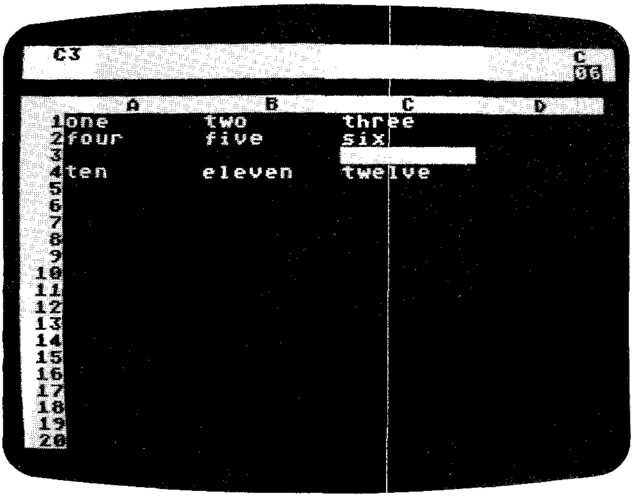
While developing a VisiCalc sheet, you may find that you need to insert additional rows or columns. The insert command gives you this ability. After you type **/I** VisiCalc expects you to enter **R** if you want a row inserted, or **C** to insert a column. It is not possible to insert a single entry position—you may only insert an entire row or column.

/IR inserts a new, blank row in the row in which the cursor is situated when you give the command. All rows that were at or below the cursor are moved down one row to make room for the insertion. VisiCalc then changes all value references in formulas to reflect the new entry position coordinates in the rows that were moved. For example, if a formula contains the coordinate C2, and a row is inserted at row 2, VisiCalc will change the coordinate to C3. The cursor will remain in its old position in the new, blank row.

Example

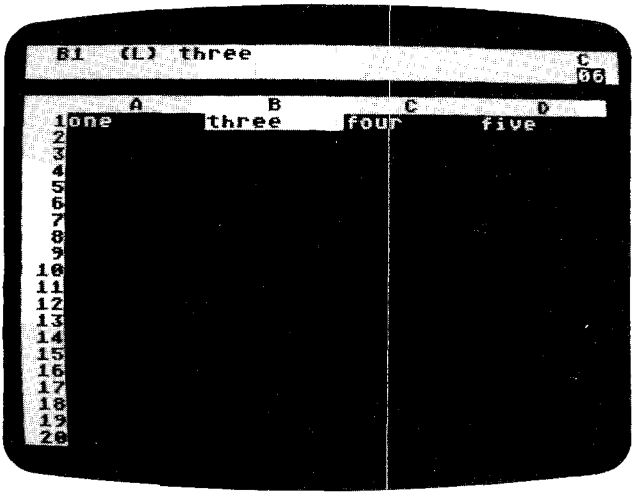


After typing **/IR**

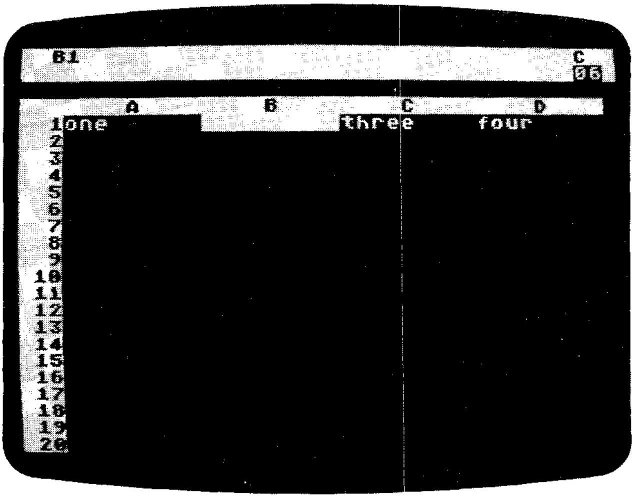


/IC inserts a new, blank column in the column in which the cursor is located when the command is given. All columns at and to the right of the cursor are moved one column to the right to make room. VisiCalc changes all value references in formulas to reflect the new entry position coordinates for the columns that were moved. The cursor remains in its original position in the new, blank column.

Example



After typing **/IC**


B1
C
96
A
B
C
D
1 one
three
four
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

The MOVE Command

/M

Move: From . . . To

Row Move: type • enter second coordinate in same column.

®

Row containing first coordinate moves to row above second coordinate.

Column move: type • enter second coordinate in same row.

®

Column containing first coordinate moves to left of column containing second coordinate.

It is sometimes desirable to change the position of a row or a column. The move command lets you do just that. VisiCalc will automatically change all value references in formulas (see VALUE ENTRY Command) to reflect the new coordinates that result when the rows or columns are moved.

When you move a row or a column, be careful that you have not moved formulas containing value references to a position in which they are calculated before those value references. Order of calculation and recalculation is discussed at length in the VALUE ENTRY Command in Part III and in Part II, Lesson Three, in the sections entitled "The Order of Recalculation" and "Forward and Circular References."

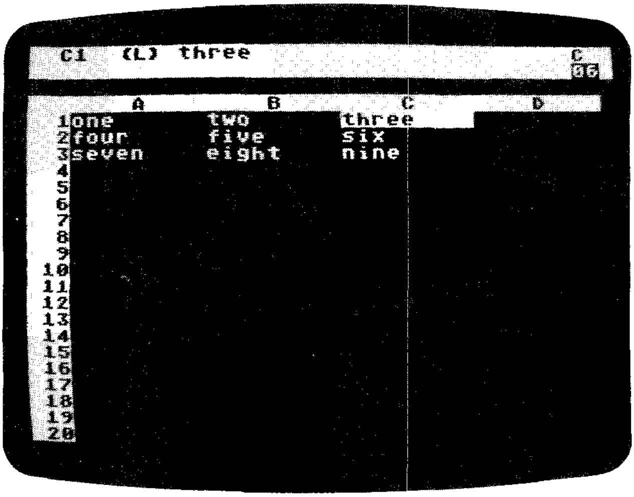
To Move a Row

When moving a row to a lower position on the sheet, row 1 to row 3 for instance, first place the cursor on the row or column you wish to move. Then, type **/M** The coordinate of the highlighted entry position will appear on the edit line. Press . and then use the cursor-moving keys to place the cursor on the row that is just below the row to which you are moving, or on the column just to the right of the desired new location. Note: *the column or row to be moved will appear just above or just to the left of the cursor's new position.* Terminate the move command with ®

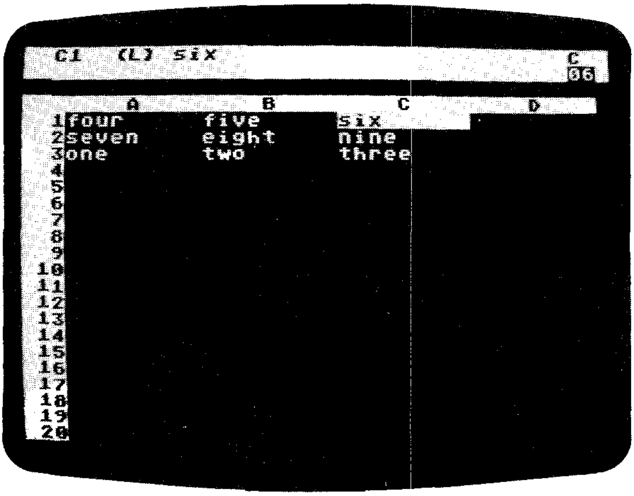
When moving rows, the cursor may be in any position within the row when you initiate the command. However, when you indicate the new location, you must use the same column coordinate. For instance, moving C10 to C5 is valid, but moving C10 to D5 is not. The same is true for moving columns. The row coordinate must be the same for the column being moved and its new location, i.e., moving A2 to D2 is valid, but moving A2 to D1 is not. When a row or column is moved, all intervening rows and columns are moved up to fill in the place vacated by the moved row or column.

Example

1. Set up your sheet as in the photo:



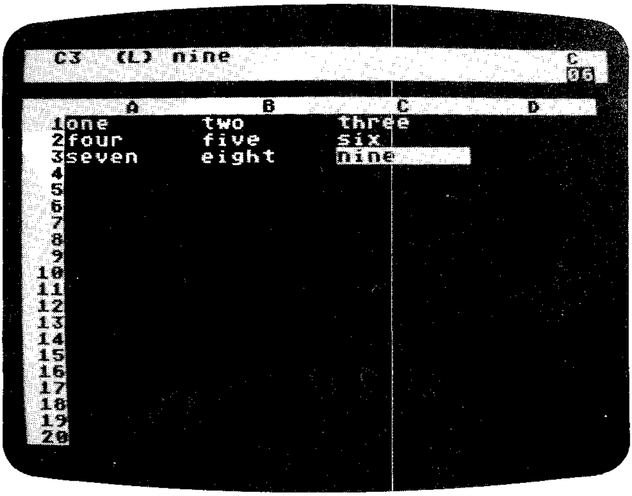
2. Type /**M** — prompt line: MOVE: FROM . . .TO — edit line: C1
3. Type . — edit line: C1. . . — Row 1 is going to be moved.
4. Press ↓↓↓ — edit line: C1. . .C4 — Row 1 is going to move to row 3.
5. Press ® — The sheet should look like the photo below:



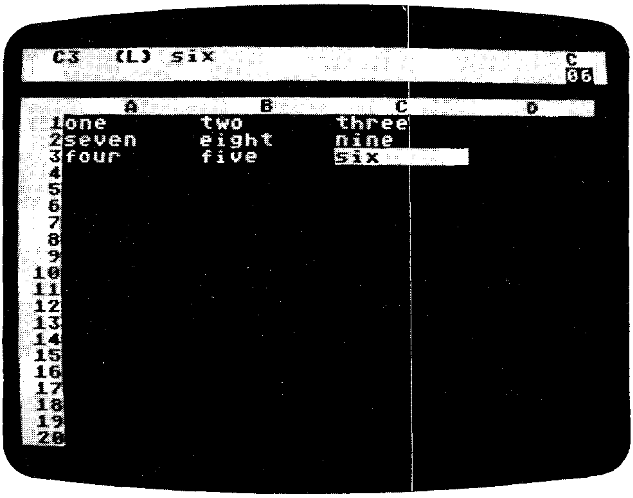
When you move a row to a higher place on the sheet, row 3 to row 2 for instance, either point with the cursor or type in the coordinate of the target row.

Example

1. Type **/CY** to clear the sheet and set it up as in this photo:



2. Type **/M**	prompt line:	MOVE: FROM. . .TO
	edit line:	C3
3. Type **.**	edit line:	C3. . .
	Row 3 will be moved.	
4. Press ▲	edit line:	C3. . .C2
	Row 3 will move to row 2.	
5. Press ®	Row 3 have moved to row 2.	



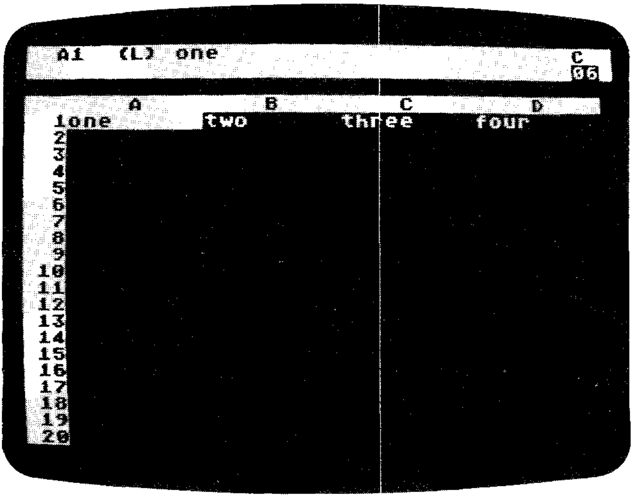
To Move a Column

To move a column to the right of its current position, first place the cursor on the column you wish to move. Type **/M** and the coordinate of the highlighted entry position will appear on the screen. Press . and then point with the cursor (or type in) to the column just to the right of the desired new location. The column will be moved to the position just to the left of the cursor.

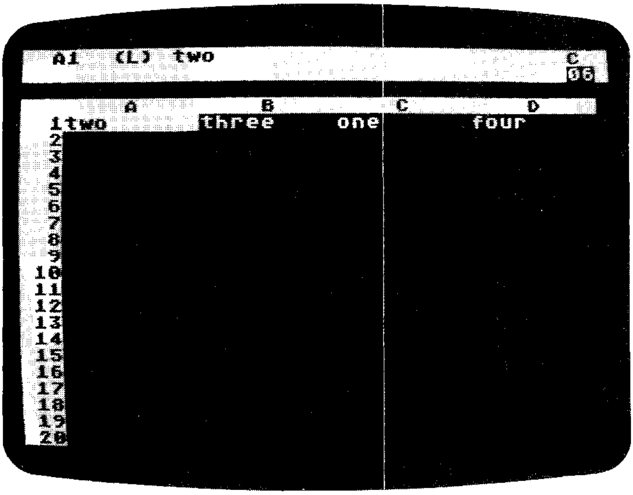
When moving columns, the cursor can be in any position within the column when you start the command, but when you indicate the new location, you must use the same row coordinate. For example, moving A2 to D2 is valid, but moving A2 to D1 is not. Terminate the move command with a ® All intervening columns are moved over to fill the place vacated by the moved column.

Example

1. Type **/CY** to clear the sheet and set it up as shown in the photo below.



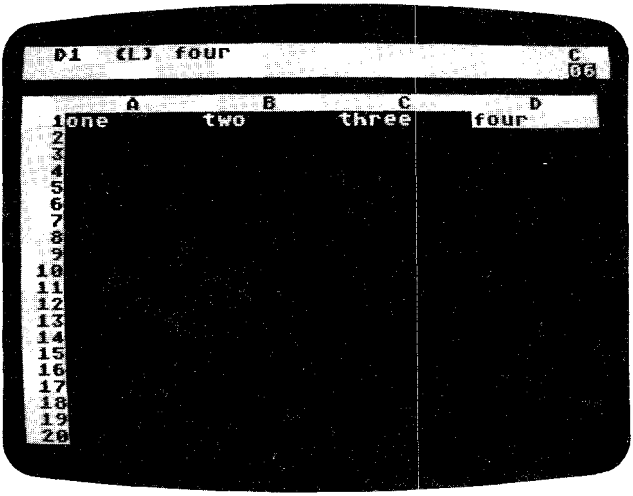
2. Type **/M**	prompt line:	MOVE: FROM. . .TO
	edit line:	A1
3. Press **.**	edit line:	A1. . .
4. Type **D1**	edit line:	A1. . .D1
5. Press ®	Column A has been moved to column C as in the photo:	



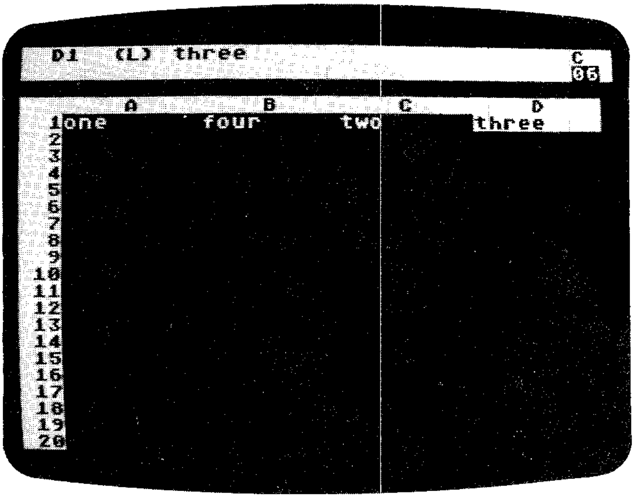
When you move a column to the left of its present position, either point with the cursor or type in the coordinate of the target row.

Example

1. Type **/CY** to clear the sheet and set it up as in this photo, with the cursor on D1:



2. Type **M**	prompt line:	MOVE: FROM. . .TO
	edit line:	D1
3. Press **.**	edit line:	D1. . .
4. Press ◀◀	edit line:	D1. . .B1
5. Press ®	Column D has moved to column B.	

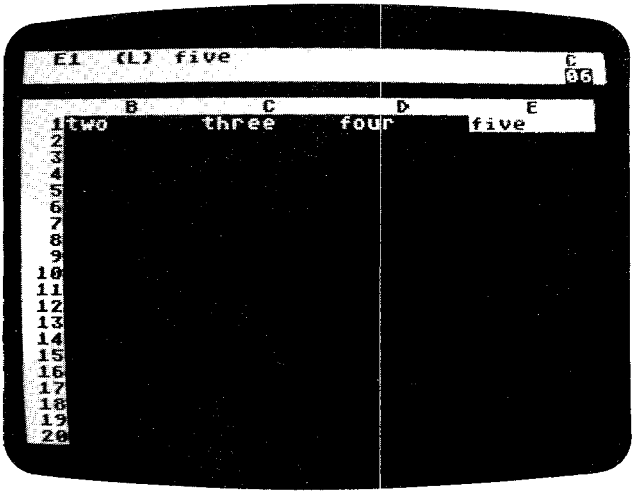


You can also type in the coordinate of the row or column to be moved, as well as the coordinate of the new location. Use the **BACK S** key to erase any unwanted coordinate, and replace it either by typing in or pointing to the coordinate with the cursor.

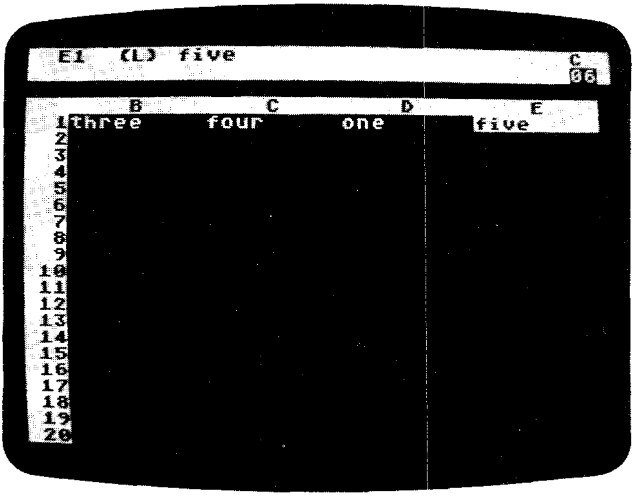
Example

1. Set up your sheet as in the photo below by typing

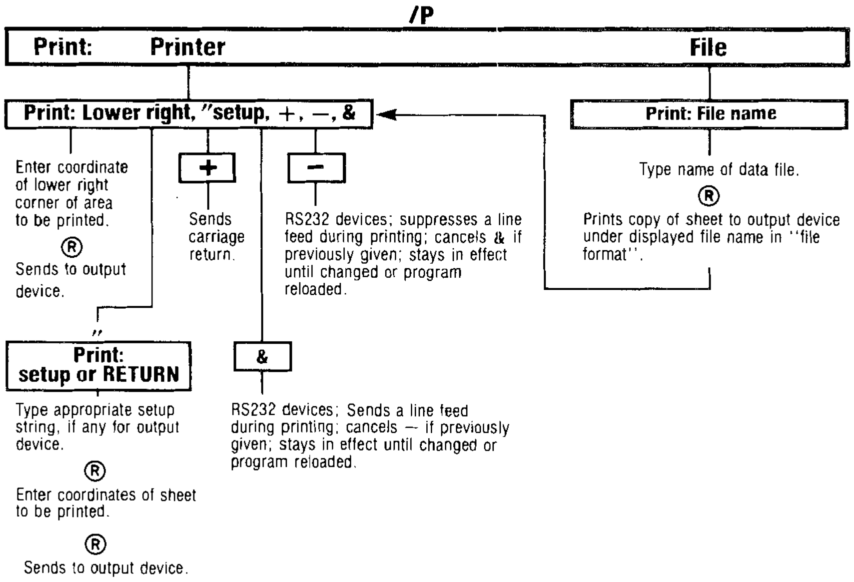
/CY	Clear screen, cursor at A1
one▸two▸three	
▸four▸five®	Cursor rests at E1



2. Type **/M**	prompt line:	MOVE: FROM. . .TO
	edit line:	E1
3. Press the **BACK S** key	prompt line:	MOVE: FROM. . .TO
	edit line:	blank
4. Type **←←←←**	edit line:	A1
5. Press **.**	edit line:	A1. . .
	cursor returns to E1	
6. Type **E1**	edit line:	A1. . .E1
	Column A will be moved to column D.	
7. Now press ®	The contents of column A are now in D. The columns that were previously B, C, and D have been moved to A, B, and C.	



The PRINT Command



The print command turns a VisiCalc sheet into a report that can be sent to your printer, to your diskette, or to any other addressable device. This discussion will cover the commands for the ATARI 820 and 825 Printers as well as the ATARI 850 Interface Module and the ATARI 810 Disk Drive. Note: you must have the 850 interface to use the 825 printer or any serial printer. You can use the print command to communicate with other ASCII devices, such as those often connected to telephone modems.

However, the exact commands needed for these devices depend on variables, the discussion of which goes beyond the scope of this manual. We recommend that you familiarize yourself with the principles of the /**P** command as given here, then consult the reference manuals for your particular equipment or see your dealer for assistance.

Let's begin with the ATARI 820. Since the column width of your VisiCalc sheet is often greater than the 820's paper can handle, VisiCalc permits you to copy your sheet in strips. If your printout will be more than 40 characters wide, read "Printing in Sections" below, before attempting to print your file on the 820. All formats (explicit and global) are taken from the window in which the cursor rests. Window divisions (see the WINDOW Command) as well as row and column borders are ignored during printing.

The Print Command for Printers

1. Position the cursor over the entry position that you wish to be printed first (in the upper left-hand position on the printout). The cursor's position determines the top row and leftmost column that will be printed. Titles that were fixed (see the TITLE Command) will be ignored, so you must insert extra rows or columns for title areas and replicate the titles (see the INSERT Command and the REPLICATE Command) if you want the titles to appear on the printout.
2. Assuming you have adequate paper in your printer, turn the printer power switch ON.
3. Type **/P** The prompt line will display:
   `PRINT: PRINTER, FILE`
4. To print out on an ATARI 820 Printer, type **P** The prompt line will display:
   `PRINT: LOWER RIGHT, "SETUP, +, -, &`
   If you have an ATARI 820 Printer, LOWER RIGHT is the only command of immediate interest.
5. Enter the lower right coordinate requested by the prompt line either by pointing the cursor to the desired coordinate or by typing it in.
6. Press ®

Let's examine the other options that appeared on the prompt line.

1. The SETUP option allows you to type characters directly to an output device. These characters are the "setup string" needed by some printers. To do this, type " and then the appropriate character string, ending with a ® (which is not transmitted).
2. Type + If you wish to send a carriage return to an output device.
3. Type **&** to set up the RS-232 mode internally. The **&** is used to send a line feed after each carriage return. Use with serial devices using the RS-232 protocol.
4. The – turns off the RS-232 mode set up by the **&**. Note that both **&** and – stay in effect until you reload VisiCalc or cancel one with the other.

Printing Formulas

The /P command will print out the *data* on your electronic sheet. But what about the formulas and formats? A good hard copy backup of your work should include the formulas too. You can print them out by typing **/SS P:** (See the STORAGE Command for discussion of /SS.) The current sheet's formulas and formats will be printed out in a column.

Printing in Sections

If you attempted to print more than 40 characters on a line, you will see that the 820 placed the 41st character on the next line, beginning at the left margin. If the area you defined on the screen was greater than 40 characters, this "wraparound effect" will ruin your printout format.

The way to beat this problem is to print out your file in sections. Once the sections are printed, they can be pasted together to simulate a wide printout. Note: this technique can be useful on printers with greater width, when an exceptionaly wide document must be generated.

The ATARI VisiCalc window is 36 characters wide (not counting the border, which is never printed). This means that you can print four unseen characters of width. Most people find it easiest to simply print one window or less at a time, simply because they can see exactly what they're doing.

To print in sections, begin as normal with step 1. However, when you arrive at step 5, choose a right coordinate within the window you are viewing (+4 more characters, if you wish). The vertical portion of the coordinate (the numeral) can be whatever depth you like, because the 820 paper supply is not a sheet, but a roll.

As an example, let's say you wanted a printout that extends from column A to column M and is five rows deep. You would begin by placing the cursor at A1 (the upper leftmost position) and conclude by entering D5 as your lower right-most coordinate. Print it out. You should also advance the paper in your printer a few lines before the next printout to separate each successive section. The extra space makes cutting the sections apart less risky.

Scroll the cursor until E column is at the left side of the screen and H column is at the right to line up the next four columns. Print this group in the same way as before.

Continue by moving one whole window to the right until you have printed all the individual sections for columns A through M. Once you have printed out all the sections, paste them down side-by-side on a piece of paper.

You can use a similar technique with the ATARI 825. The 825 can easily handle two complete screens (72 characters width) at once. Or you can use the ATARI's condensed print mode, which prints 16.5 characters per inch. To do this, you must use a "setup string". Choose the SETUP option by typing " Press the Escape key (marked **ESC**) then hold down the Control key (**CTRL**) while pressing **T**. To return to the standard 10 character per inch mode, type **ESC CTRL S** when you finish your printout.

Creating a Print Format File

The purpose of the **/PF** command is to allow you to prepare a sheet for printout on serial printers or printers with codes other than those immediately available on the ATARI. Essentially, the **/PF** command turns the data on your sheet into ASCII strings and saves them in a text file. By using a special program, written in BASIC or other computer language, your sheet can be incorporated into word processing or simply printed out.

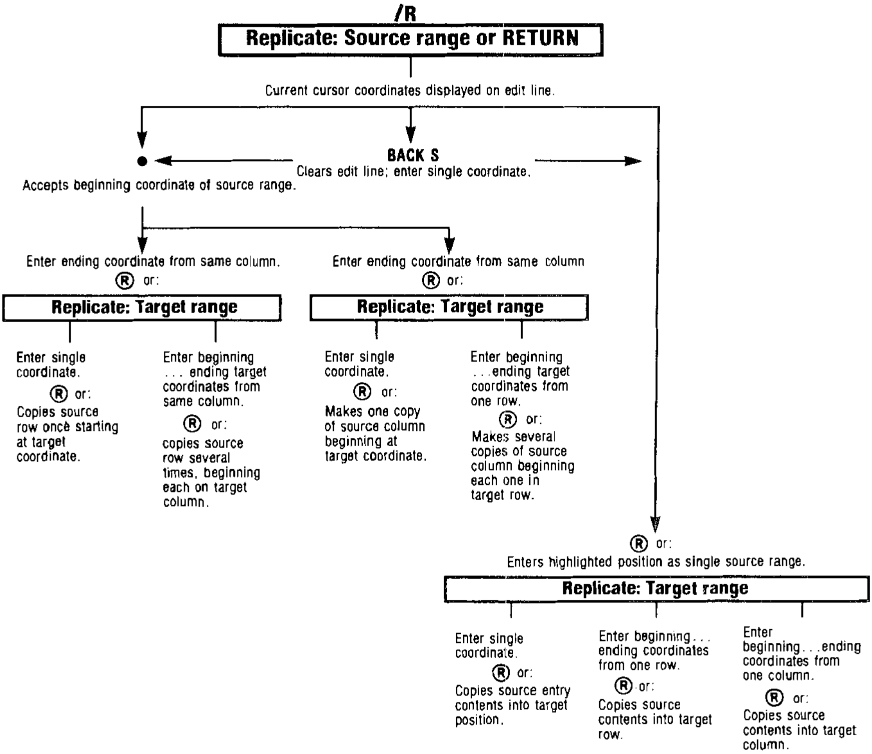
To copy your sheet into a "print format" file on a diskette so that another program can read it, start with the cursor positioned on the first entry that you want printed in the file, then:

1. Type **/P** The prompt line will display:
   `PRINT: PRINTER, FILE`
2. Type **F** and the prompt
   `PRINT: FILE NAME`
   appears. The rules for file names apply here. See the File Name section of the STORAGE Command for details.
3. Press ® and when the prompt line `LOWER RIGHT, "SETUP, +, —, &` appears, enter the coordinate of the lower right hand corner you wish to print. You may do this placing the cursor over the desired coordinate or by typing it in. Then press ®.

> The file will be written onto diskette in print file format. Note that VisiCalc cannot read or reload files in this format. Use /PF only when you intend to write your own BASIC or other language programs for use with VisiCalc.

Use the /PF command as well to print the sheet on a *serial* printer (connected to the ATARI 850 Interface Module). Begin by positioning the cursor on the upper leftmost coordinate. **Type /P**. Respond to the prompt by typing **F** Instead of entering the sheet's file name, however, enter **R:** and press ®. At this point VisiCalc will ask for your lower right coordinate. Enter it and press ® and your printout will begin. Note: some printers may need the setup string. Consult your printer's manual if the approach illustrated here does not work.

The REPLICATE Command



The replicate command allows you to copy the contents of any entry position, including labels, values (numbers, expressions, and formulas), formats (the FORMAT Command), and blank entries (the BLANK Command). You may copy a single entry from one place to another, copy a single entry position into a row or a column, or you may reproduce a single row or column as many times as you like.

However, the replicate command does not permit you to copy a row into a column, or to copy a matrix (several rows or columns at once). Complex copying operations must be done with a series of replications or with the **/S#S** option (see the STORAGE Command).

To use the replicate command, you must supply two (and sometimes three) sets of information:

1. the source range
2. the target range
3. indication of the relationship of a value reference (see the VALUE ENTRY Command) to the new position

A range may be a single entry position as well as a whole or partial row or column. Ranges are specified by entering a starting coordinate for the range, followed by typing a period, and finally by specifying the ending coordinate. Entering of coordinates can be accomplished by simply typing them in or by pointing to them with cursor. A range may not cross the sheet diagonally. A complete source and target range specification will appear on the edit line in the following pattern:

beginning source entry position coordinate . . . ending source entry position coordinate: first target entry position coordinate . . . ending entry position coordinate

If the beginning and ending coordinates in your *source range* are identical, you will copy one entry only. If they are different but fall in the same column, you will copy that section of that column. If they are different and fall in a row, you will copy that section of that row.

The coordinates you put in the target range tell VisiCalc the starting position for each copy to be made with the replicate command. If you want one copy of an entry position, a row, or a column, your target range should contain one coordinate (F9, for example). If you specify two different coordinates for your target range (F9 . . . F15, for example), you will get multiple copies of your source.

To copy from one entry position to another, give one coordinate as the source range and one as the target range.

Example

1. Type >**A1**®	This places the cursor over the entry position you want to copy. If A1 is blank, type **100**®	
2. Type /**R**	prompt line:	REPLICATE: SOURCE RANGE OR RETURN
	edit line:	A1
	By starting the command with the cursor on A1, VisiCalc automatically entered A1 to begin the source range.	
3. Press ®	prompt line:	REPLICATE: TARGET RANGE
	edit line:	A1 . . . A1:
	You have told VisiCalc to begin copying the contents from entry position A1 and to end with A1. A1 is the "source range" consisting of one entry position.	
4. Type **D1**	prompt line:	REPLICATE: TARGET RANGE
	edit line:	A1 . . . A1: D1
	This identifies entry position D1 as the start of the "target range," that is, the entry position to which the contents of A1 will be copied.	

5. Press ® — The replication is completed. The value 100 is now in entry position D1 as well as A1, the highlight is still at A1, and the control panel has been cleared for a new command.

To create a column by making several copies of one entry, give one coordinate as the source range and two coordinates within a single row as the target range.

Example

Repeat steps 1 through 4 in the example above. Change step 5 to:

5. Type **.D100®** — The contents of entry position A1 will now appear in entry positions D2, D3, D4, through D100, as well as in D1.

This procedure is especially useful for setting up display formats (see the FORMAT Command) before entering a large group of numbers. Assume, for instance, that a column will contain sales figures and therefore should always display numbers rounded to two decimal places. Place the cursor on a blank entry position and type **/F$** (see the FORMAT Command) to attach the "dollars and cents" format to the position. Then replicate that entry position into the positions in the column that you want to have the dollars and cents format, using the procedure in the example above. The entry positions will not change in appearance if there are no values in them at this point. However, when you begin entering numbers into them, they will all be displayed with two decimal places.

To copy a column from one position on the sheet to another, give the top and bottom entry position coordinates of the column as the source range. For instance, A1 . . . A32. For the target range, give only the coordinate of the top entry position of the new column. VisiCalc will fill in the rest.

Example

To set up your sheet for this example, enter the numbers 1 through 10 in positions A1 through A10. You need not clear the sheet because VisiCalc will write over any old entries. (See the VALUE ENTRY Command.)

1. Type **/R** — prompt line: `REPLICATE: SOURCE RANGE OR RETURN`; edit line: current cursor position coordinate. VisiCalc will put the coordinate of the entry position to which the cursor is pointing on the edit line. If this is not the coordinate you want to begin your source range, press the edit line.
2. Press **BACK S** — To erase first coordinate (this is an illustration for this example and is not necessary when the coordinate is the one you want to begin the source range).
3. Type **A1** — edit line: `A1`
4. Type **.** — edit line: `A1 . . .`
5. Type **A10** — edit line: `A1 . . . A10`

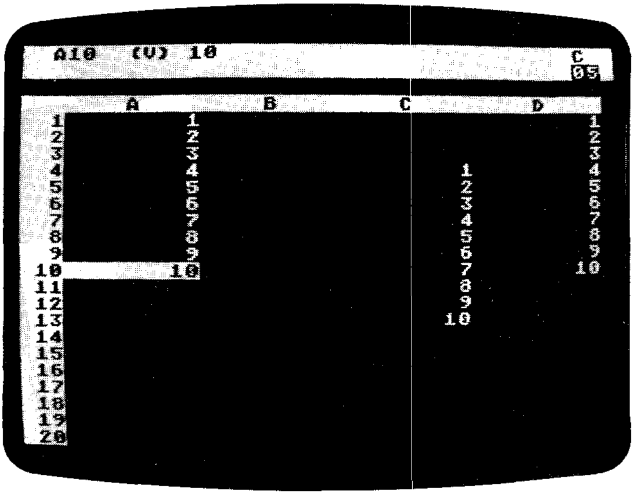
6. Press ® prompt line: REPLICATE: TARGET RANGE
   edit line: A1 . . . A10:
7. Type **C4** edit line: A1 . . . A10: C4
8. Press ® The contents from your source range (A1 to A10) are now in your target (C4 to C13). Note that you did not need to type the ending coordinate of the target range. The cursor has been returned to the position it occupied before you typed /R.

To make several copies of a column, enter the top and bottom coordinates of the column as the source range and the beginning and ending coordinates of a row as the target range. Each copy of the source column will "begin" in the target row.

Example

Do the example above again, only this time change steps 7 and 8 to:

7. Type **D1.K1** edit line: A1 . . . A10: D1 . . . K1
   In the target range, D1 will be the top of the first new column, E1 the top of the second new column, and so on ending with K1 as the top of the last new column. The target range must be adjacent coordinates in one row or VisiCalc will only copy the column once and stop.
8. Type ® The results will look like this:



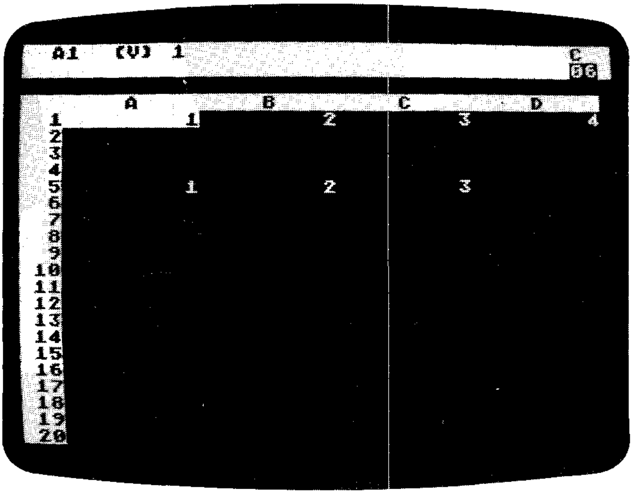
You may scroll your window over to L1 to see all of the effects of these few keystrokes on your sheet.

To copy a row from one position to another, specify the beginning and ending coordinates in that row as your source range (A1 . . . C1). Then give the beginning coordinate only for the row in which you want the copy to appear (A5). VisiCalc will automatically interpret this target coordinate as the first entry position in a row and will fill in the correct ending position.

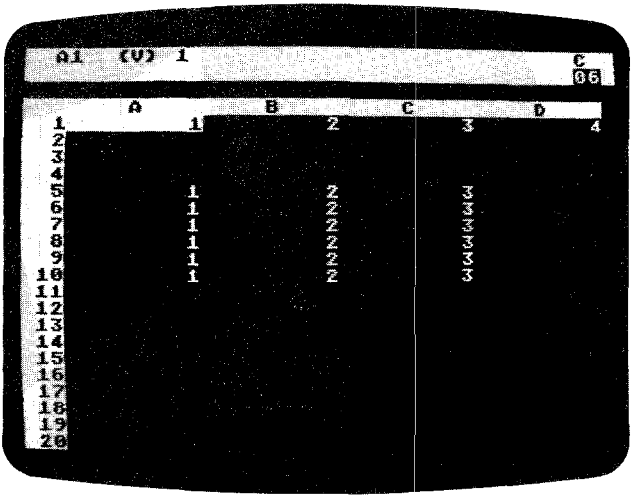
Example

To set up for this example, clear the screen with **/CY** and enter the numbers 1 through 5 across the top row on your sheet (positions A1, B1, C1, D1, E1):

1. Type >**A1**®
2. Type **/R.C1**® edit line: `A1 . . . C1:`
3. Type **A5**
4. Press ® The result should look like this:

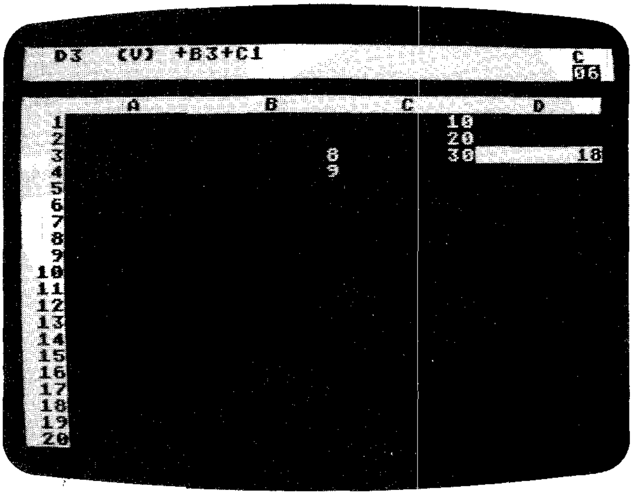


To see what happens if you give two coordinates for the target range (A5 . . . A10, for example), begin again at step 1. At step 3, type **A5.A10**. You should see results like those in the photo below.

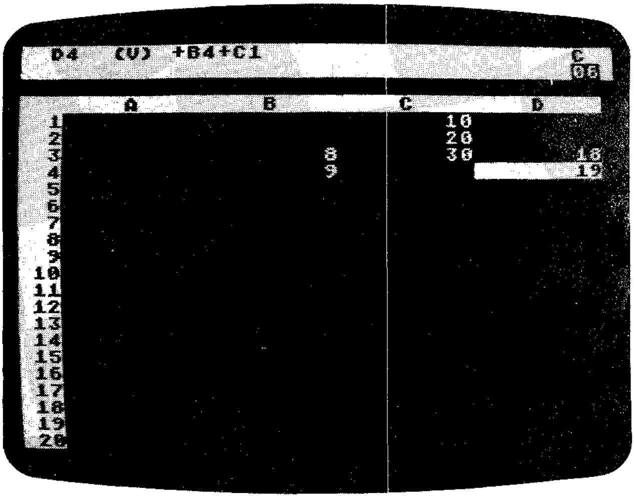


Replicating Value References

When you replicate a formula that contains entry position coordinates (value references), you must tell VisiCalc whether or not to copy each value reference exactly as it appears in the source range or to change that value reference as it is copied. The change will replace the original value reference with the one that falls in the position that is relative to the location of the copied formula. Therefore, the replicated value reference will be to the replicated formula as the original value reference is to the original formula. The following examples will illustrate this relationship:



You can see from the entry contents line in the photo above that the formula in position D3 contains value references to positions B3 and C1. B3 is in the same row as the highlighted formula and two columns to the left. C1 is two rows up one column over from D3. Look at the photo below.

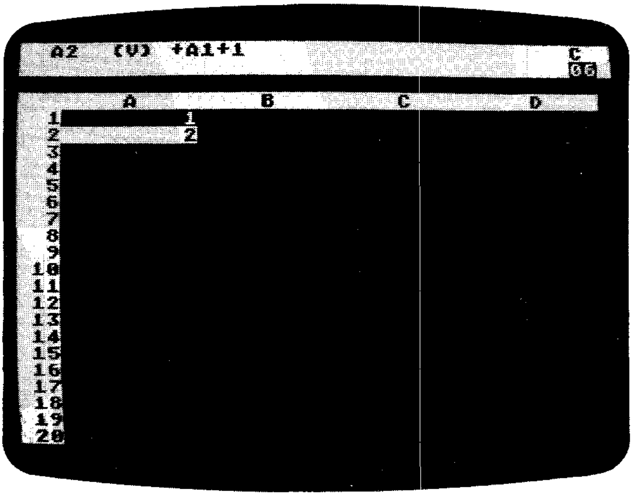


The formula in D3 has been replicated into position D4, but it has also been changed. The formula in D4 is now B4+C1. The value reference B4 is in the same row and two columns left of the new formula in D4 (in the same *relative position*). The value reference C1 is exactly the same in the formula at D3 and the formula at D4. In other words, it has not been changed to maintain the same position relative to the placement of the formula.

When a source range that is being replicated contains value references, VisiCalc places each value reference on the edit line with a highlight on it. The prompt line instructs you to type **R** if the value reference is to be relative, or **N** if it is not to be changed in the new formula. After this procedure has been completed for each value reference, VisiCalc will finish the replication.

Example

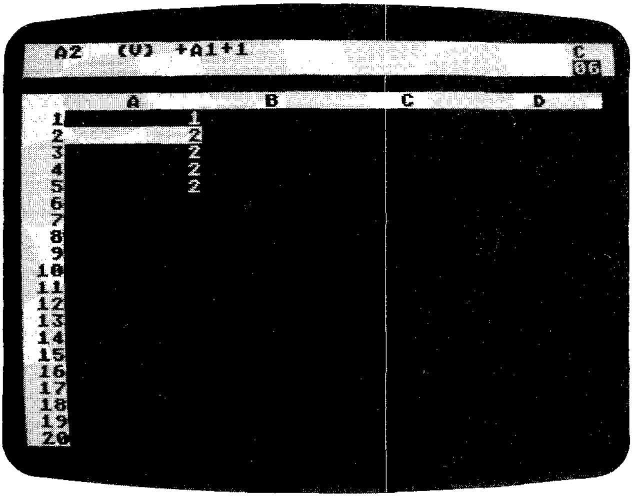
1. Type **/CY** — To clear the sheet.
2. Set up your sheet as in this photo:



3. Type **/R**®	prompt line:	REPLICATE: TARGET RANGE
	edit line:	A2 . . . A2:
4. Press ↓.	prompt line:	REPLICATE: TARGET RANGE
	edit line:	A2 . . .A2: A3 . . .
5. Press ↓↓↓®	prompt line:	REPLICATE: NO=NO CHANGE, R=RELATIVE
	edit line:	A2: A3 . . . A5: +A1

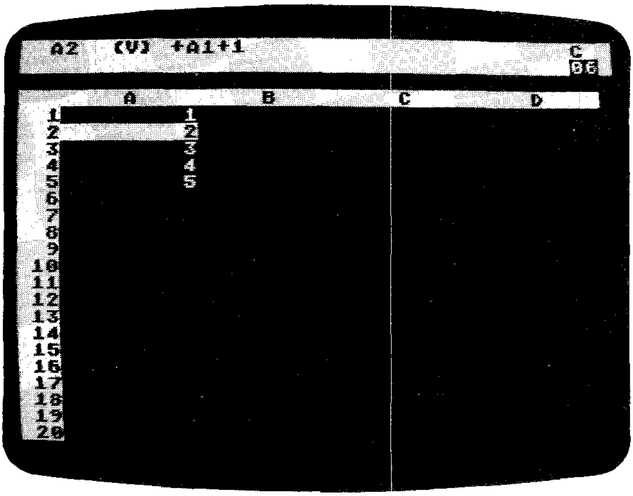
The small rectangle highlights the value reference A1 in the formula being replicated. Replication actually takes place one entry position at a time. The edit line indicates that the first operation is copying from A2 into A3. VisiCalc wants to know whether you want the copies made on a relative or no change basis.

6. Type **N** Your sheet will look like this:



Move the cursor down the column. Notice that each copy of the formula contains the value reference A1 just as it was in the source range. This is the result of choosing NO CHANGE instead of RELATIVE.

Let's make a direct comparison. Repeat steps 1 through 5 in the example above. Then, at step 6, type **R** instead of N. Your screen should look like this when you have completed the example.



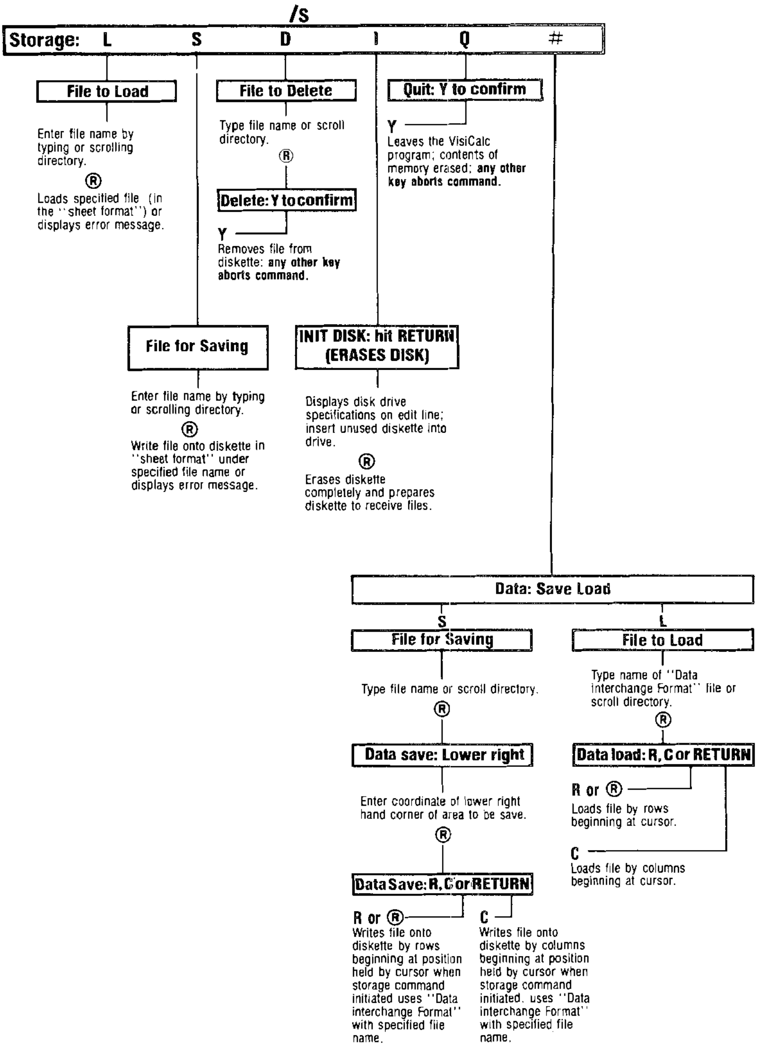
Move the cursor over A3, A4, and A5 again and check the formulas as shown on the entry contents line. The value reference in each entry position has been

changed to cite previous position as its source (a relative description), instead of "the value reference which occurred in the source formula" (A2).

It is possible to replicate a formula into a position in which proper relative value references cannot be assigned. Turn back to the two screen photos at the beginning of this section ("Replicating Value References"). If, for example, you copy the formula at D3 into position A3, then the relative position of the value reference B3 will be located off the sheet to the left! The way in which VisiCalc evaluates such a value reference is undetermined.

You can find more examples of the use of the replicate feature in Part II, Lesson Three, of this manual. Also, you must be careful not to introduce forward or circular references or incorrect calculation order into your sheet when you replicate formulas. These topics are thoroughly discussed in Part II, Lesson Three in the sections entitled "The Order of Recalculation" and "Forward and Circular References," and also in Part III, the VALUE ENTRY Command.

The STORAGE Command



The storage command lets you save copies of your current VisiCalc sheet on diskette, load saved sheets back into the computer, initialize new diskettes for use with VisiCalc, and gives you a way to quit VisiCalc.

File Names

Any electronic sheet that has been saved on diskette is a **file**. You must assign each file a name unique to the diskette it occupies. When you save any file to diskette, the file name and the address of where the file is located

on the diskette are saved in that diskette's directory. If you were to use a file name that you had already used, the more recent file would be written over the older file, erasing it.

A valid file name can be no longer than eight characters in length, the first of which must be a letter. The rest of the name can include numbers. Thus, FILETWO and FILE2 are both valid. File names cannot include punctuation, the space character or any control or other special characters. FILE TWO and FILE/TWO are invalid and, if entered, will cause an error message.

File Name Prefixes

Besides the file name proper, VisiCalc also recognizes prefixes and suffixes. These are not included in the eight characters allowed for the file name. Prefixes are used to identify a device to which a file can be written or from which it can be read. VisiCalc allows four prefixes: **D*n*:** to identify a particular disk drive, **C:** for cassette files, **R*n*:** for RS-232 devices, and **P:** for printers.

The **D*n*:** prefix is necessary only if you use two or more disk drives. If, after loading VisiCalc from drive 1, you wish to use another drive you must tell VisiCalc with the appropriate prefix by typing D, the drive's code number (*n*) followed by a colon and then the file name. Thus, for a file with the file name FILE2 in drive 3, you would type D3:FILE2

Once a drive has been prefixed, it becomes the "default" drive. That is, VisiCalc automatically looks to that drive whenever any drive command is given. To return the default condition to drive 1, you must prefix a file name with D1: though nothing keeps you from making drive 2 or drive 4 your next default drive.

The **C:** prefix is for saving and loading sheet files from cassette. Cassettes do not recognize file names as such. So, simply typing **/SS C:** ® will elicit two beeps from the ATARI, after which you simultaneously push the PLAY and RECORD buttons of your ATARI 410 to save the particular sheet. Likewise, after typing **/SL C:** ® you will hear one beep signaling you to push the PLAY button to load a sheet into the computer. See your ATARI 410 manual for more details.

Use the **R*n*:** prefix whenever you want to load a file from or save a file to any RS-232 dsvice. The argument for R (*n*) is the port number. The colon may be followed with a valid baud rate such as 300 or 9600.

The **P:** prefix allows you to save your screen's formulas and formats as a report after typing /SS. By printing out your sheet with the /P command (giving a printout of data only) and then printing it out with /SS P: to get hard copy of the formulas, you will have a complete printed record of your sheet. Note: you can begin this command with the cursor anywhere on the screen. The same information will be printed out in the same order.

File Name Suffixes

VisiCalc automatically adds a suffix on to any file name when you save its file. This suffix allows VisiCalc to distinguish among the different types of files that it and other programs generate.

Most common to VisiCalc is the **.VC** suffix, indicating that the file is a VisiCalc electronic sheet. VisiCalc will add a **.PRF** suffix to any file that is saved as a print format file. To generate a print format file, type **/PF** and give the file name.

Press ® and give the LOWER RIGHT coordinate. Press ® again, and VisiCalc will save your file with a .PRF suffix. PRF files are text files composed of ASCII strings. As such they are accessible by other programs.

Finally, if a file has been generated under the Data InterChange Format, a **.DIF** suffix will be appended. Neither the prefix nor the suffix count against the eight characters allowed for valid file name.

Scrolling and Wild Cards
To allow you to find and load or save your files more quickly, VisiCalc allows you to scroll through the file names on the diskette. To scroll the file names, type **/SL** then press the ▶. The drive will whir and then display the first file name it finds in the directory on the edit line. If that isn't the file you want, press ▶ again. You can repeat this procedure until you have scrolled through every file name on the disk. To select a file for loading, simply press ® when the name of the file you want appears.

You can also use scrolling to modify a file name already in the directory—a handy technique for updating. For example, if you had loaded and modified a file called SALES3 and wanted the update version to be called SALES4, you would type /SS ▶. Continue to press the ▶ until the name SALES3.VC appears on the edit line. Then erase the 3 by using **BACK S** and replace it with 4. Because VisiCalc will reappend the .VC suffix, just press ® to save the current sheet as SALES4.

VisiCalc allows you to use * as a "wildcard." That is, you can substitute * for any file name or any part of a file name, provided that you specify the file type by its suffix (.VC, .PRF, or .DIF). Thus, you could type **SALES*.VC** and repeat ▶ as many times as necessary to see all file names in the SALES series and only those file names. If you wanted to find which DIF files the diskette contained, you could type **/SL *.DIF** and then use the ▶ to see only the DIF file names. Note: /SL, /SS, and /SD can all be used to scroll up wild card file names.

Loading a File from Diskette
/SL loads a sheet back into the computer's memory if the sheet was saved with the /SS command (discussed below).

When the file has loaded, the sheet will appear in the window exactly as it was when you gave the /SS command to save it. VisiCalc will not clear the sheet that is in use when the /SL command is given, but will load the sheet over it. Wherever an entry position has contents on both the current and the loaded sheet, the entry position contents of the just-loaded sheet will replace the previous contents. Blank entry positions in the loaded sheet will not erase the contents of corresponding entry positions in the old sheet. This characteristic, called "overlay" gives you the ability to combine sheets by loading previously saved sheets over each other.

If you want to work with only the contents of the sheet you are loading from the diskette, be sure to clear the current sheet from the screen by typing **/CY** (see the **CLEAR** Command).

Insert the diskette containing the file to be loaded into the current default drive (usually drive 1) and follow the steps below. If your data diskette is in any other drive than the default drive, you must tell VisiCalc the drive number by prefixing the filename with the Drive Code Number (such as D2: for drive 2), when you are asked for the filename.

1. Type /**S**	prompt line:	STORAGE: L S D I Q #
2. Type **L**	prompt line:	FILE TO LOAD
3. Type the file name used when the file was saved with /SS ®	edit line:	file name
Or press ➧	edit line:	First file name on disk will appear.
	Each time you press ➧, VisiCalc will examine the directory and place the next qualifying file name it finds on the edit line.	
	Continue pressing ➧ to "scroll" through the directory until the name of the file you wish to load appears on the edit line.	
4. Press ®	VisiCalc will load the file with the name that was on the edit line. While the file is loading, characters will flash at the left side of the edit line. When loading is finished, the sheet will appear in the window, looking just like it did when you saved it.	

The directory scrolling described in step 3, above, both puts the existing file names on the edit line and allows you to edit these names. When a file name is on the edit line, you may change the name by backing up the small rectangle with **BACK S** and then typing the characters you wish. This feature might be useful when, for example, you have forgotten a file name. As you scroll the directory, you may find a file name that causes you to remember the name of the file you want to load. Say the name on the edit line is PROJFEB.VC and you remember that the file you want is called PROJAUG.VC. Press the **BACK S** key until FEB.VC has been deleted from the edit line, and type **AUG.VC**, then press ® and PROJAUG.VC will be loaded (if it is on the diskette currently in one of the default drive). If you name a file that is not on the default drive, the message ERROR: NOT FOUND will display on the screen.

If you should press ➧ when the last file name is on the edit line, you will exit the load mode (without an error message). To keep searching for the file you want using a single drive, simply remove the diskette you've just checked, insert the next, and type /**SL** (and, optionally, ➧) If you have multiple drives with disks in them, you can type /**SL** then, before entering either the file name or pressing ➧, enter the drive code number.

Saving Files on Diskette

/**SS** is the storage save command and will save an entire electronic sheet on a diskette in the VisiCalc format, so that it can be loaded back into the computer's memory with the /SL command. Before you can use a diskette with the storage save command, the diskette must be initialized (use VisiCalc's /SI command, explained below in the section on /SI). All formulas, labels, titles settings, explicit and global formats and window settings, as well as the position of the cursor, will be saved and in force when the sheet is loaded.

Each sheet is saved, or recorded, on a diskette under a name you specify, called the **file name**. The file name is recorded in the diskette's "directory." Each file name is unique to each diskette, so if you save a sheet with a file name

already in the directory, the earlier file with will be replaced by the *current* file saved with the same name. A diskette has enough room to hold many electronic sheets.

Should the diskette become full while VisiCalc is recording a sheet into a file, a message that the diskette is full will appear on the edit line. VisiCalc will have saved all that it could under the file name you gave, but not the entire sheet. If this happens, delete the incomplete file from the full diskette (see /SD below) and save the sheet on another, less full, initialized diskette.

The file name can be up to 8 characters long (no spaces or punctuation marks). The first character of the name must be a letter. You may compose the rest of the name with letters, or numbers, or both.

VisiCalc will automatically append the characters **.VC** to every file name saved with the /SS command or you can add a suffix yourself.

This suffix will allow you to differentiate files you saved in the VisiCalc format from any other files you may have on your diskette.

When you load VisiCalc to start a session, the computer will automatically assume that the diskette on which you want to save a file is located in drive 1. Drive 1 is said to be the **default** drive. If you want to save the file on a diskette in drive 2, you must preface the file name you enter with the characters **D2:**

For example, D2:MYFILE would save the file named MYFILE on the diskette in drive 2. The D2: is the **drive specification**. Once you've given a drive specification, that drive number becomes the default drive and VisiCalc will automatically look to it whenever you issue a drive-oriented command. This state of affairs stays in effect until you specify a different drive.

To save a file, do the steps listed below. The cursor may be anywhere on the sheet when the /SS command is started.

1. Type **/S**	prompt line:	STORAGE: L S D I Q #
2. Type **S**	prompt line:	FILE FOR SAVING

3. If necessary, type the drive number prefix (including the colon). Then type in the file name. If you choose to use the ➧ to find a file name, you have two alternatives. First, you can keep pressing ➧ until the right file name appears on the edit line. Then, just press ® to save the current sheet to that name. Second, you can use ➧ to find a file name that you want to update (MYFILE1, MYFILE2, MYFILE3, etc.). To update or change a name, press **BACK S** to back up the small square and erase the version identifier. Then, type in the new characters. Note: you do not have to retype .VC; VisiCalc appends it automatically. In either case, you can press ➧ and VisiCalc will place the first file name it finds in the directory on the edit line. Each time ➧ is pressed, the next file name in the directly will appear, as VisiCalc scrolls through the directory. Note: you can scroll all the way through the directory without saving to any of the names. When you have the desired name go on to step 4.

4. Press ®	The drive will whir as the electronic sheet is saved on the diskette under the file name you specified in step 3.

The option in step 3 of letting VisiCalc put file names from the directory on the edit line can be very useful. It allows you to examine the file names in the diskette directory, so that you do not unintentionally use an existing name for the file you are about to save.

Deleting Files from a Diskette

/SD will delete from the diskette the file whose name appears on the edit line.

1. Type **/SD** prompt line: FILE TO DELETE
2. Type the file name, preceded by the drive number, if necessary. Or you may press ➧ and VisiCalc will place the first name it finds in the diskette's directory on the edit line. Each time you press ➧, VisiCalc will examine the directory and place the next file name it finds on the edit line. Continue pressing ➧ to "scroll" through the directory until the name of the file you wish to delete appears on the edit line.
3. Press ® prompt line: DELETE: Y TO CONFIRM
   Any other key will cancel the command.
4. Type **Y** VisiCalc will delete the file from the diskette.

Initializing Storage Diskettes

/SL initializes a new, blank diskette or a previously used diskette. During the initialization process, VisiCalc scans the diskette and writes a series of position identifiers on it. Any contents on a used diskette will be erased during the process. A diskette must be initialized with this command before it can be used to save VisiCalc sheets.

When you load VisiCalc to start a session, the computer will automatically assume that the diskette to be initialized is located in drive 1. Drive 1 is said to be the **default** drive. If you want to initialize the diskette in a drive other than 1, you must tell VisiCalc the disk drive number. The drive number is called the **drive specification**. Each time you specify a drive number other than the default, the drive specified becomes the default drive, and VisiCalc will then assume it is to use the diskette located in that drive for all file operations.

The command to initialize a diskette may be given at any time when the control panel is clear. The electronic sheet currently in the computer's memory will not be affected by the command. The instructions below assume the default drive is 1.

1. Insert a blank or other diskette (the contents of which you don't care about) into drive 1.
2. Type **/SI** prompt line: INIT DISK: HIT RETURN (ERASES DISK)
   edit line: D1:
   The second character, the 1, is the drive specification.
3. Press ® The diskette in drive 1 will be initialized.

If the diskette to be initialized is in another drive, press **BACK S** to erase the 1: (leaving the D) from the edit line. Then type the correct drive number followed by a **:**

Example: **D2:**

The diskette in the drive specified will be initialized leaving the current VisiCalc sheet unchanged. The drive you specified is now the default drive.

Quitting VisiCalc
/SQ is VisiCalc's "Quit" command. /SQ allows an easy exit to other programs, erasing the current electronic worksheet and always returning the default to drive 1 in the process. **/SQ** has the same effect as turning the power on.

1. Type **/SQ**	prompt line:	QUIT: Y TO CONFIRM
2. Type **Y**	The computer leaves the VisiCalc program. Any other key cancels the command.	

3. To begin VisiCalc again, place the VisiCalc program diskette in drive 1 (make sure its power is ON) and turn the ATARI's POWER switch ON.

Saving Files in the Data Interchange Format
Files saved with the command /S#S are recorded on the diskette in the Data Interchange Format (DIF). This format affords a way for other programs, such as those written in BASIC, to use the data that is on the sheet. The data that was saved in files with the /S#S command can be loaded back onto a VisiCalc sheet with the /S#L (load a Data Interchange Format file) command.

/S#S saves a rectangular area of the sheet, which you define, in a file in the Data Interchange Format. This command saves labels, blanks, and *calculated* values at full precision in the entry positions on the sheet. The formulas from which the values were derived are not saved (see the VALUE ENTRY Command for discussion of formulas and values).

The DIF allows for two orientations of the data. You can specify to VisiCalc which orientation you want by pressing R or C at the appropriate time. For data that you are going to use only with VisiCalc, always save the data with the R specification. For a complete description of the use of the Data Interchange Format, see the "Programmer's Guide to the Data Interchange Format" inserted in the binder holding this manual. To use the command:

1. Position the cursor at the entry position that is in the upper left hand corner of the rectangular area you want to save.

2. Type **/S#**	prompt line:	DATA: SAVE LOAD
3. Type **S**	prompt line:	FILE FOR SAVING
4. Type the file name.	The file name must follow the same rules outlined in the discussion of /SS, above. VisiCalc will automatically append the suffix .DIF to files saved with this command.	

Or press ➧ to look at the file names already in the directory. Continue pressing ➧ until the desired file name appears on the edit line. You may change the name on the edit line by pressing **BACK S** and typing characters for the new name.

5. Press ®	prompt line;	DATA SAVE: LOWER RIGHT

6. Type or point with the cursor to the entry position in the lower right corner of the rectangular area to be saved. You may save as little as one column or one row if you wish.

7. Press ®	prompt line:	`DATA SAVE: R, C OR RETURN`
8. Press ®	The prompt line is blanked. The rectangular area of the sheet defined by the upper left and lower right cursor positions will be saved.	

/S#L will load back the data you saved with the /S#S command into any position on the sheet you indicate.

1. Position the cursor on the entry position in the upper left corner of the area to be filled by the data being loaded.

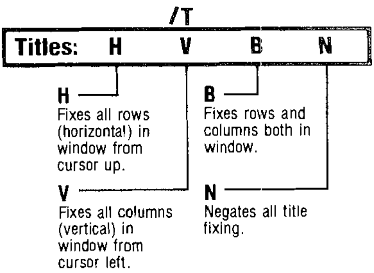
2. Type **/S#L**	prompt line:	`FILE TO LOAD`
3. Type the desired file name	The file named should be one saved with the Data Interchange Format.	

Or press ➧ to scroll through the directory as described in the /SL command discussion, above, until the desired file name appears.

4. Press ®	prompt line:	`DATA LOAD: R, C OR RETURN`
5. Press ® or **R**	The selected file is read into the computer's memory and placed on the VisiCalc sheet starting at the current cursor position.	

If you would like the data loaded transposed—what would have been loaded across the rows is loaded down the columns, and vice versa—press **C** at step 5.

The TITLE Command



Most VisiCalc sheets are considerably larger than the screen display window. To see all the entries on the sheet, you must move the window away from the top and left edges, so that any row and column titles you may have entered move out of sight.

The title commands allow you to fix titles in place on the screen so that they remain in view as you scroll the window about the sheet. Begin the command from a cleared control panel by typing **/T**. The prompt line on the control panel will display `TITLES: H V B N`. The possible keystrokes are:

H To fix horizontal titles.
V To fix vertical titles.
B To fix both horizontal and vertical titles.
N No titles (to "unfix" titles).

Which columns and/or rows are to be fixed is determined by the position of the cursor when you initiate the command. All rows at and above the highlight are fixed by H. All columns at and to the left of the highlight are fixed by V. B fixes all rows at and above and columns at and to the left of the cursor.

VisiCalc terminates the command automatically and clears the control panel immediately. There is no change on the sheet, but the effect of title fixing becomes apparent when you begin scrolling the window away from the top and left borders.

You cannot use the arrow keys to move the cursor to an entry position that is within a fixed title area. The cursor will flash when it bumps into the fixed titles. Use > to jump the title barrier (see the GO TO Command) and the coordinates of an entry position within the fixed title area; for example, >A1®.

In certain circumstances, VisiCalc will automatically unfix titles you have set. It does this when, in order to follow your commands, the titles must not be set. For instance, if you scrolled the window so that column B was at the left edge, then fixed vertical titles and then at some point gave the command to go to a coordinate in column A (see the GO TO Command), VisiCalc would unfix all titles. In order to obey the command to go to column A, the window had to be scrolled to the left to bring A into view. If you have fixed vertical titles, and then you expand the column width (see the GLOBAL Command) so that only one column can be displayed on the screen at one time, VisiCalc will automatically "unfix" the title settings. When you return to a narrower column width, you will have to refix the titles.

The VERSION Command

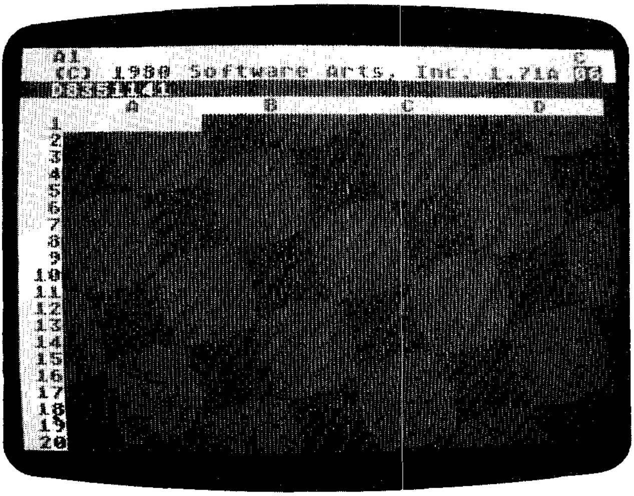
/V

© 1980 Software Arts, Inc. 1.xx

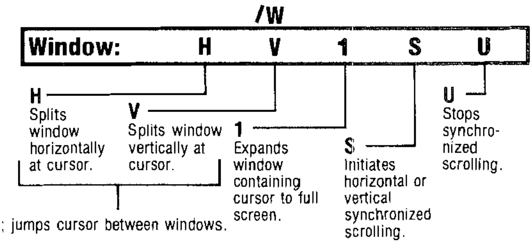
Displays copyright notice and version number on prompt line; serial number on edit line; clears automatically with next keystroke.

To see the copyright notice and the version and serial numbers of your VisiCalc program, type **/V** when the control panel is clear. You may use this command anytime, without disturbing the contents of a sheet you may have loaded. As soon as you press any key, the notice will disappear from the control panel.

Should you need to call or write with questions about VisiCalc, be sure to include the version number that appears when you give the version command. The photograph illustrates how the notice appears on the screen.



The WINDOW Command

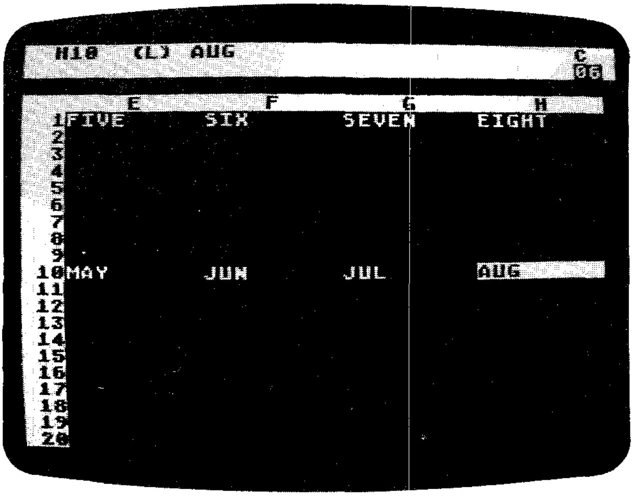


Often you will find yourself wishing to compare rows or columns which are too far apart on the sheet to be displayed in a single window on your computer screen. The window command allows you to split your screen so that you can view the sheet through two windows simultaneously. Each window may be independently scrolled around the entire sheet to let you see rows or columns which are widely separated on the sheet. You may also look at the same entry positions with each window having its own global column width and format (see the GLOBAL Command) modifying the display in each one.

/WH (Window Horizontal) splits the window into two by placing a second column border (A,B,C,D . . .) between the row containing the highlighted entry position and the next row down. Each window may be moved individually to view the same or different parts of the sheet.

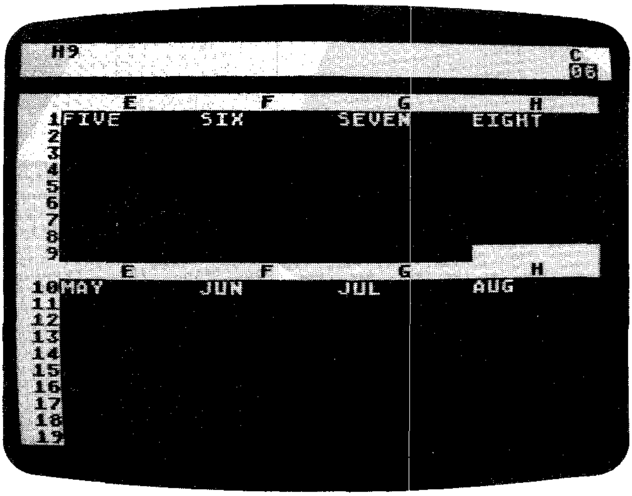
Example

1. Type **/CY** — This clears the VisiCalc sheet.
2. Type **ONE→ TWO→ THREE→ FOUR→ FIVE→ SIX→ SEVEN→ EIGHT®**
3. Type >**A10®**
4. Type **JAN→ FEB→ MAR→ APR→ MAY→ JUN→ JUL→ AUG®** — Your screen should look like this:



3. Type **/W** prompt line: WINDOW: H V 1 S U

4. Type **H** Your screen will change to:



Each window will now view the sheet independently. The cursor can move around the sheet in the top window. Move it up and to the left until the ONE is highlighted in the top window. Press **;** to move the cursor into the bottom window. Pressing **;** will always make the cursor jump to the last position it had in the other window. It will jump to the upper left entry position the first time it enters a window.

All VisiCalc commands will work in both windows and you can see the effects on the sheet through either window. The two exceptions are the /GC (Global Column) and /GF (Global Format) commands, which are set in one window at a time (see the GLOBAL Command).

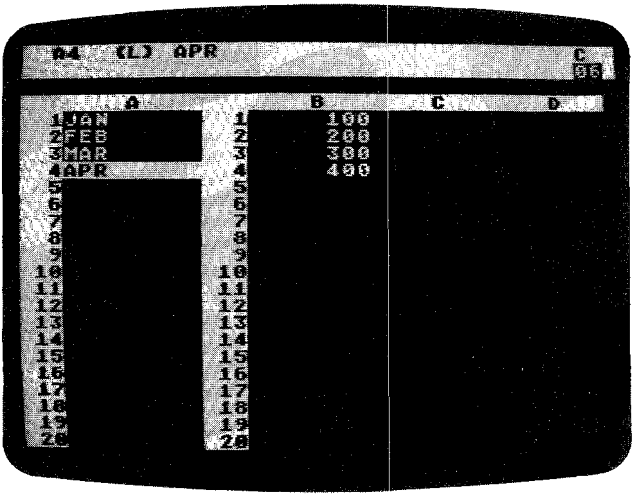
Remove the horizontal window by typing **/W1** The window containing the cursor will then occupy the whole screen using the current format settings of that window. A horizontal window must be removed before a vertical window can be instated and vice versa. The size of each window is determined by the position of the cursor at the time the window command is used.

/WV (Window Vertical) splits the window by adding a second row border (1 2 3 4 5 . . .) after the column containing the cursor. When the screen has been split vertically, the columns in the right window may be slightly narrower than those in the left window, to make room for the second row border.

The vertical window behaves exactly like the horizontal window described above. Note that when you return to one window, the format settings of the window in which the cursor is located go into effect in the single window. The column width of the right window will also be in effect if the cursor is in that window when **/W1** is typed.

Example

1. Type **/CY**
2. Type
   JAN➧ FEB➧
   MAR➧ APR®
3. Type >**B1®**
4. Type **100➧ 200➧**
   300➧ 400®
5. Type **/WV** — Your screen should resemble the photo below.



The vertical window can be particularly useful when you wish to keep a column of information visible in one window while you scroll the other window around to compare columns in different places on the sheet.

/W1 (One Window) displays the window containing the cursor in full screen position. All the global format settings in that window take effect in the one window.

/WS (Windows Synchronized scrolling) synchronizes horizontal motion in horizontal windows or vertical motion in vertical windows so that moving the highlight in one window also moves the other.

/WU (Window Unsynchronized) turns off synchronized scrolling.

The last three window command options (/W1, /WS, and /WU) may only be used after a /WH or /WV is in effect.

The REPEATING LABEL Command

/–

Label: Repeating

Type any characters.

®

Character sequence repeated across column width.

Sometimes it is useful to draw lines or other borders across an entire column or across several columns. The repeating label command will repeat any sequence of characters you enter across the entire width of a column. If you change the column width (see the GLOBAL Command), the continuous sequence will be modified so that it still fills the column. When you replicate (see the REPLICATE Command) the entry containing the repeating label, you can form a line or other visual break across your sheet.

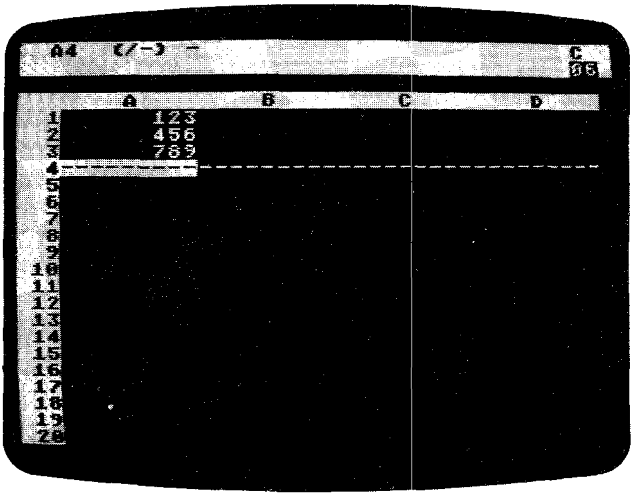
Example

1. Position the cursor in the entry position to contain the repeating label.		
2. Type /–	prompt line:	LABEL: REPEATING
3. Type –	prompt line:	LABEL: REPEATING
	edit line:	–

4. Press ®

VisiCalc will extend the sequence across the column. For example, with a general column width (9 characters) you see --------- in the entry position.

5. Use the replicate command to copy the continuous label as far across the sheet as needed.



PART IV. INDEX

–INDEX OF SPECIAL CHARACTERS–

(in ascending order by ASCII code)

Index